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ABSTRACT

To study the development of syntax in the language of deaf students, the Test of Syntactic Ability was constructed and administered to approximately 450 deaf students (10-18 years old) and 60 normal children (8-10 years old). The test contained 22 subtests covering seven major syntactic structures: relativization, conjunction, complementation, pronominalization, question, formation, negation, and the verb system. Although results showed gradual improvement of deaf Ss' performance, the improvement was slight and the retardation in comparison to hearing Ss was large. Developmental stages for deaf Ss on the structures tended to parallel the stages reported for hearing children. Certain distinct structures, apparently rule ordered, were found to appear consistently in the language of the deaf Ss but rarely or never in the hearing Ss. Comparison of the deaf Ss' knowledge of the various structures with the appearance of those structures in a series of reading texts analyzed during the project revealed differences so large as to make it unlikely the deaf subjects could read the texts. It was concluded that instruments for the assessment of syntactic structure, and curriculum materials tailored to the language of deaf children, need to be developed. (Author/LS)

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FINAL REPORT

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SYNTACTIC STRUCTURES IN THE LANGUAGE OF DEAF CHILDREN

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ABSTRACT

In order to study the development of syntax in the language of deaf students, the Test of Syntactic Ability was constructed containing 22 subtests covering seven major syntactic structures: relativization, conjunction, complementation, pronominalization, question, formation, negation, and the verb system. The tests were administered to approximately 450 deaf students aged 10 through 18 years and 60 children with normal hearing aged 8 through 10 years. Although results showed gradual improvement of deaf students' performance, the improvement was slight and the retardation in comparison to hearing children was very large. Developmental stages for deaf children on the structures tended to parallel the stages reported for hearing children. Of special interest were structures, apparently rule ordered, which appeared consistently in the language of the deaf subjects but rarely or never in the hearing subjects. Comparison of the deaf students' knowledge of the various structures with the appearance of those structures in a series of reading texts analyzed during the project revealed differences so gross as to make it unlikely the deaf subjects could read the texts. It was concluded that instruments for the assessment of syntactic structure, and curriculum materials tailored to the language of deaf children, need to be developed.

PREFACE

This report contains the theoretical formulations, procedures, major findings, and conclusions of a long term program of research on the syntactic structure of the language of deaf children and youth. While the report contains the essential information of the research, other means of dissemination have been utilized throughout the life of the project. Eighteen papers have been delivered at conventions of the Alexander Graham Bell Association for the Deaf, the American Instructors of the Deaf, the American Speech and Hearing Association, the Illinois Speech and Hearing Association, and the Linguistic Society of America. A series of eight articles has been published or accepted for publication in the Journal of Speech and Hearing Research. These articles form the major professional reporting for the project, although summary articles have appeared in other professional journals. A course in transformational generative grammar designed for teachers of deaf children and incorporating major findings from the research program was constructed for PLATO, the computer assisted instructional program at the University of Illinois. That course has been used by several other universities. Finally, a book on transformational grammar, stressing its applications to the language problems of deaf children and youth and incorporating findings from the present research is being published by the Alexander Graham Bell Association for the Deaf, Inc. Collectively, these reports, papers, articles, and books contain most of the information generated by the research, and the major findings and implications are contained in the present Final Report.

The theoretical framework within which this research was conducted is transformational generative grammar. In the past several years, a growing number of transformationally oriented linguists (especially the group concerned with "Generative Semantics") have questioned some of the basic assumptions of Chomsky's early formulations -- particularly as regards the role of meaning (semantics) in a grammar, and the interaction of the syntactic and semantic rules in sentence production. It is not yet clear what the implications of this developing position are for language acquisition theory and research. These new insights were not widely available when the present research was begun, and it has therefore been influenced mainly by the theoretical stance of Chomsky's proposals in Syntactic Structures (1957) and Aspects of the Theory of Syntax (1965). We believe, however, that the knowledge and the insights into the syntactic structure of the language of deaf children furnished by the present investigation will remain current for an appreciable time.

The authors listed on this report represent only a few of the people who contributed significantly to the research. During the course of the project a large number of graduate

assistants from linguistics, psychology, education and other areas worked on various aspects of the program. Any one familiar with the operations of graduate departments and research units of universities will recognize the truth of our simple statement that this project could not have been accomplished without the help of those graduate students.

Special thanks go to Keith Russell for his significant linguistic contributions, and to Paula Menyuk, Jonnie Geis, and Alice Streng for their important consulting services. We thank Joyce Fitch for supervising the typing and organization of the report and others who assisted in preparing the manuscript, especially, Ruth Quigley and Janet Leveque.

A very special thanks is accorded the schools that provided the subjects; American School at Hartford, for Deaf, Inc.; J.H.S. No. 47, School for the Deaf; St. Mary's School for the Deaf; Alexander Graham Bell School; Illinois School for the Deaf; Minneapolis Hearing Impaired Children Program; Missouri School for the Deaf; Dade County Public Schools; Florida School for the Deaf and Blind; Mississippi School for the Deaf; Tarrant County Day School for the Deaf; Oklahoma State School for the Deaf; Arizona State School for the Deaf and the Blind; California School for the Deaf - Riverside; Lexington School for the Deaf; Portland Regional Facility for the Deaf, Portland Public Schools.

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CHAPTER 1

PURPOSE AND THEORETICAL FOUNDATIONS OF THE STUDY

The purpose of this study was to examine and to describe and explain the syntax of deaf children and its development. While considerable attention is usually given to syntax in the teaching of deaf children, this is an area which deserves more careful scientific investigation from a new and possibly more productive viewpoint, that of transformational generative grammar. The importance of syntax in language use is borne out by the fact that a sizable vocabulary and the ability to pronounce English sounds perfectly will not in themselves guarantee success in communication. For example, notice the following sentence:

(1) The shooting of the gangsters frightened me.

Sentence 1 is ambiguous as to whether someone shot the gangsters or the gangsters themselves did the shooting. A knowledge of words of the sentence and their pronunciation gives no indication of its ambiguity; only with an understanding of the syntactic structure of the sentence does the ambiguity become apparent. Similarly, lexical and phonetic information are of no assistance in determining the synonymity of such sentences as:

(2a) The man swallowed a cookie.

(2b) A cookie was swallowed by the man.

In fact, some of the project results indicate that limited syntactic knowledge can lead to what we have called Reading Surface Order, which gives an interpretation for the passive sentence 2b above of:

(2c) A cookie swallowed the man.

In addition, notice that the following sentence can be seen to be structurally well-formed (i.e., "grammatical") by any fluent speaker of English (who at the same time will find it difficult to attach any meaning to the component words):

(3) Kroofs are murp to heeg.

Thus it seems as though judgments of grammaticality often have little to do with vocabulary.

It is apparent, then, that a clear understanding of the language of deaf children, along with reliable methods for its improvement, can be possible only with a detailed understanding of its syntactic structure. The magnitude of the task is made even clearer by a comparison of the following sentences:

(3a) So they stopped and get a dog brought to the picnic with them. (Deaf student, age 18 years)

(3b) Mike and Pat had a race to see who could get done eating the fastest and Mike won because he had a big mouth. (Hearing student, age 8 years)

In addition, it has been the feeling of those involved in this project that phenomena of the type briefly listed above can be most accurately considered in the framework of transformational grammar.

Because of the difficulties involved in communicating orally with deaf children, and because younger children have great difficulty reading and writing, the research was concentrated on comprehension and production of syntax in written language by deaf students 10 through 18 years of age. Four major questions guided the investigation:

1. How well established are the syntactic rules of English in the language of deaf students at age levels from 10 to 18 years?

2. Are there developmental stages for these rules, and if so, how do the stages compare with those for hearing individuals?

3. Is there an order in which the various syntactic structures are acquired by deaf individuals, and is this order similar to the order in which the structures are acquired by hearing individuals?

4. Do deaf individuals acquire the same syntactic rules as hearing individuals, but at a retarded rate, or do they acquire some rules that never operate in the grammar of hearing persons?

Theoretical Foundations

The theoretical framework within which this project's research was carried out is transformational generative grammar, sometimes referred to as transformational grammar or generative grammar. This modern linguistic approach originated from the work of Noam Chomsky, introduced in 1957 by his book Syntactic Structures. The theory of transformational grammar attempts to account for the fact that native speakers of a language are able to generate novel utterances which they have not previously encountered; it also attempts to explain the fact that sentences differing greatly in their syntactic structure (for example 2a and 2b) may nevertheless be closely related semantically.

The theory of transformational grammar is relatively new. Traditionally, the structure of the English language was described in terms of traditional grammar, or school grammar, a somewhat artificial system patterned after Latin paradigms. Traditional grammar tended to be "prescriptive", that is, concerned with what one should or should not say, often with little concern for what educated people really were saying. Around the middle of the present century this approach began to yield (in theoretical research, at least) to a set of American English structuralist grammars which were based on usage, and were therefore "descriptive" rather than "prescriptive", and which promised to be able to account for linguistic structures more adequately and more elegantly than previous approaches. The structuralists emphasized scientific empiricism and claimed that only observable language data, that which was actually spoken or written, was valid as a basis for linguistic study. Basing their studies on concrete linguistic data, they were able to develop a much more orderly, consistent description of linguistic structures than traditional descriptions had provided. Because of inherent limitations of their self-imposed restrictions, the preponderance of research during this period dealt with phonology. Nevertheless, a few structuralists did concern themselves with syntax, and their methods of analysis are still widely accepted. As a result of the restrictions placed on linguistic research by the structuralists, the field of linguistics became much more scientific and systematic. Linguists of this period emphasized the structure of language; that is, the interrelatedness of the elements of languages as members of language systems, rather than as isolated units. All of this resulted in great progress, and structuralism held sway past the middle of the present century.

Much of the work in linguistics over the past fifteen years, however, has shared the general orientation of transformational grammar. Chomsky's books (1957; 1965) and a number of papers by Chomsky and other linguists have greatly influenced psychologists working in the area of language acquisition, and a great many studies have been produced since the early 1960's under the impetus of this point of view.

Competence and Performance

In his early formulation of transformational generative grammar, Chomsky (1957) defined syntax as "the study of the principles and processes by which sentences are constructed in particular languages. Syntactic investigation of a language has as its goal the construction of a grammar that can be viewed as a device of some sort for producing the sentences of the language under analysis (p. 1)." According to Chomsky, a fundamental distinction must be made between competence, the speaker-hearer's knowledge of his language and performance, the actual use of language in concrete situations. We might draw the analogy of a talented musician who has never formally studied music but is able, "by ear," not only to reproduce familiar compositions but also to create new, completely different ones of his own. His performance is derived from his competence, or his underlying knowledge of the rules of composition. Notice that if he is asked what rules he uses to compose, he might not be able to put them into words--just as a native speaker of English will not be able to describe his own competence in his language. The problem for the psycholinguist studying the language of children is to determine from the data of performance the underlying system of rules that has been mastered by a child (his language competence) and which the child uses in particular situations and which are reflected in his linguistic performance. Although transformational generative grammar is viewed as a model of grammatical competence, as a model of language knowledge rather than a model of language usage, the measures used by the psycholinguist to infer competence at any given developmental level are obviously performance measures--measures of language comprehension and production.

It was the purpose of this study to follow psycholinguistic procedures in examining data from the written performance of deaf students in order to deduce some of the rules they use to process (both comprehend and produce) English sentences. A series of related procedures described in chapter 3 was adopted to enable us to achieve that aim.

The Makeup of a Transformational Grammar

Whereas the goal of traditional and structural linguists had been to analyze and describe isolated sentences as they were spoken or written, Chomsky emphasized the goal of explanation; first, explanation of the relationships between sentences and their relationships to the overall structure of the language, and second, explanation of the knowledge which a native speaker has of his language, not necessarily explicit knowledge which he is able to put into words, but knowledge which he uses in producing grammatical sentences of his language. For example, any native speaker of English knows the following things about his language.

1. Given a string (or sequence) of words from his language, he knows whether the string is grammatical (a "good" sentence) or ungrammatical.

2. He recognizes ambiguities--not only semantic ones, but those having to do with the interrelationships of the elements of a sentence. This is evident in such sentences as The shooting of the gangsters frightened me. Although he may not see the ambiguity immediately, a native speaker would agree that the interpretation of the sentences is different depending upon whether the gangsters are the ones doing the shooting or the ones being shot.

3. He also recognizes synonymity between sentences, sometimes of greatly divergent structures. Consider, for example, the following sentences, which all mean basically the same thing.

(4a) That elephants have big ears is disputed by no one.

(4b) No one disputes that elephants have big ears.

(4c) That elephants have big ears is not disputed by anyone.

(4d) It is not disputed by anyone that elephants have big ears.

(4e) It is disputed by no one that elephants have big ears.

(4f) The fact that elephants have big ears is disputed by no one.

.... and so forth ....

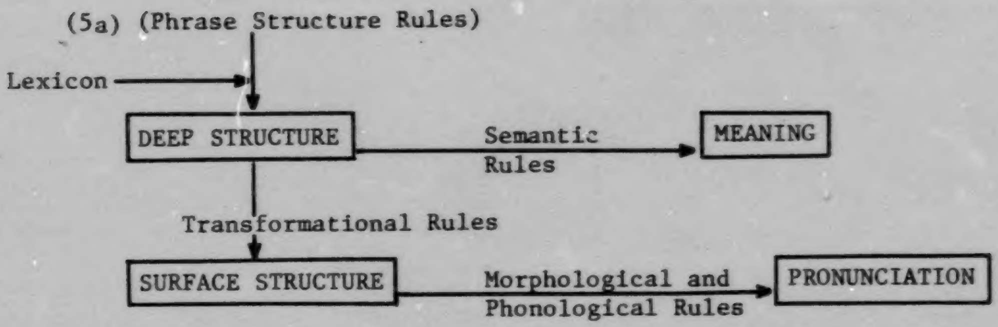
4. Finally, he recognizes the internal functions of sentences. He knows that in a sentence like Mathematicians like numbers, the first and third words, though of a same type, are different in function--one performs the liking, while the other is the object of the liking.

With his knowledge of English, a speaker is able to create new or novel utterances (for example, Zurks are animals that have three eyes and carry their babies in leather pouches on their plorps) which have never before been produced. These sentences may display not only new vocabulary, but also novel sequencing and structure. In fact, the number of possible English sentences is infinite; in the poem, The House That Jack Built, a new sentence can continue to be added at the end of the string indefinitely.

This remarkable ability is acquired by hearing children within just a few short years. Since it seems unreasonable to assume that a child simply memorizes an infinite number of sentences, Chomsky proposed that language use is the result of the existence of a finite number of rules which, applied in certain ways, have the capacity for producing an infinite number of utterances.

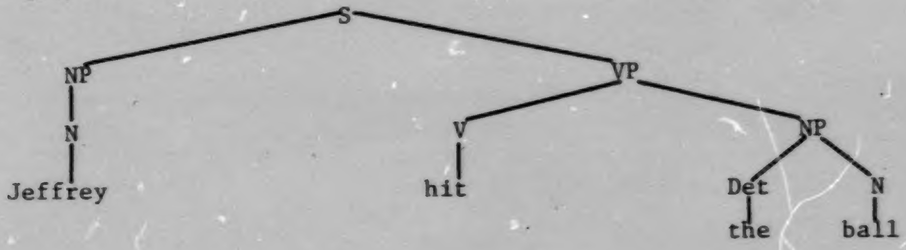
In Chomsky's view, a grammar, i.e., that set of rules which produces the sentences of a given language, consists of the following components:

(5a)

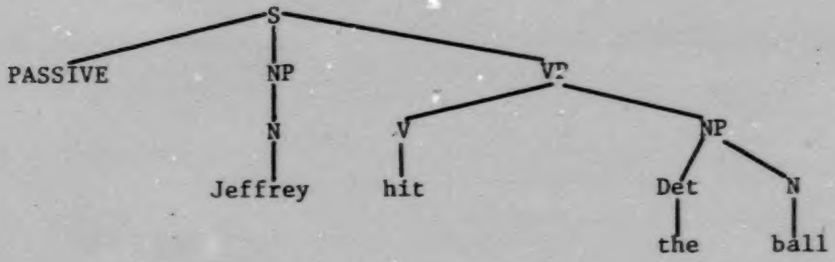

(Phrase Structure Rules)
Lexicon
DEEP STRUCTURE
Semantic Rules
MEANING
Transformational Rules
SURFACE STRUCTURE
Morphological and Phonological Rules
PRONUNCIATION

The deep structure, which is the level at which all grammatical relationships are determined, might also be referred to as the "conceptual" structure of a sentence. The deep structure is much closer to (in fact, in some later formulations of transformational grammar, actually is) the meaning of the sentence than is the surface structure, the string of morphemes as they actually are observed. Deep structure, surface structure, and all intermediate structure can be represented by linguistic "trees." Simplified examples are the following, where: S = Sentence, NP = Noun Phrase, VP = Verb Phrase, V = Verb, N = Noun, Det = Determiner.

(5b)

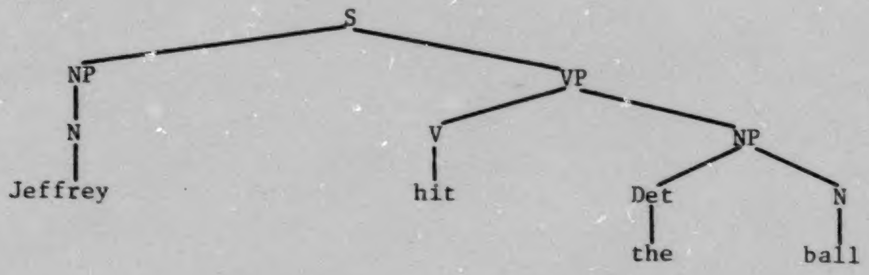

S
NP
N
Jeffrey
VP
V
hit
NP
Det
the
N
ball

(5c)

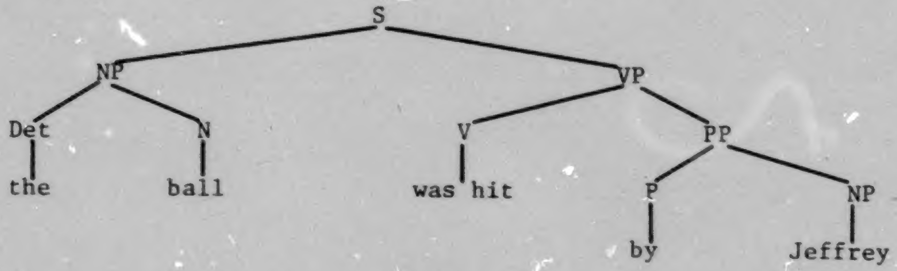

S
PASSIVE
NP
N
Jeffrey
VP
V
hit
NP
Det
the
N
ball

By definition, Jeffrey is the deep subject of the verb in both sentences; the ball is the object. The only difference between the two deep structures is the presence or absence of passive. However, the active and passive versions of the sentence seem very different on the surface, as the result of the transformations which apply to them. Because the second undergoes a passive transformation, while the first does not, the surface structures turn out to be approximately the following.

(6a)



(6b)



Notice that in sentence 6b the (surface) subject is now *the ball*, while the object is *Jeffrey*. Nevertheless, any native speaker understands that in reality it was Jeffrey who did the hitting, and the ball which was hit. Also, he knows that sentences 6a and 6b are very similar in meaning, a fact which is far from clear by reference to their surface structure. However, reference to the deep (conceptual) structures can explain both of these facts.

In addition to displaying the underlying, "deep" grammatical relationships of the elements of a sentence, the postulation of deep structure also helps to explain certain types of ambiguity and synonymity difficult to explain otherwise. For example, consider the sentence, *The shooting of the gangsters frightened me*. Under any analysis which considers only the surface structure of the sentence, its ambiguity cannot be accounted for except by ad hoc means. However, if deep structure is allowed, it is possible to postulate two different deep structures, one of which contains a structure, *The gangsters shot* (with its appropriate tree structure) while the other contains a structure, *Someone shot the gangsters*. The two deep structures, upon application of the appropriate transformations, merge into the ambiguous surface structure, *The shooting of the gangsters frightened me*. Similarly, synonymity of sentences is accounted for by postulating identical, or near-identical, deep structures for each, with application of transformations resulting in widely varying surface structures.

Phrase structure rules are those which determine the grammatical relationships represented in the deep structure, or equivalently, the "shape" of the deep structure trees. The lexicon consists of two parts: (a) a "dictionary" listing each of the morphemes (or minimal meaning units of the language--e.g., dog, -ing)and syntactic, semantic and phonological information about each; and (b) an "insertion" component which places morphemes in appropriate positions in the deep structure tree. Semantic rules derive meaning from the deep structure. Morphological rules are those which determine the final sequencing and shape of morphemes in the surface structure, including the formation of verb tenses (e.g., go + past = went), plurals (e.g., ox + plural = oxen), and so forth. Finally, the phonological rules result in the appropriate pronunciation of the sentence.

Semantic and phonological rules relate to syntax only indirectly, and were not considered in this project. The research has been concerned mainly with transformations--those which apply in the formation of conjoined sentences, relative clauses, questions, complements, and negative sentences, as well as the systems of verbs, pronominalization and reflexivization. Others of the grammatical components have also been involved in the research, but to a limited degree. The major goal of the project has been to describe the syntactic (mainly transformational) rules which deaf children implicitly "know" and use in producing their written language.

In the following chapters, for the sake of economy, linguistic trees will not generally be drawn. It will be important to remember that a linear typewritten form such as, The shooting of the gangsters frightened me is an abbreviation of a linguistic tree and all that it represents.

In the past five years or so, a growing number of transformationally-oriented linguists (especially the group concerned with "Generative Semantics") have questioned some of the basic assumptions of Chomsky's early formulations--particularly as regards the role of meaning (semantics) in a grammar, and the interaction of the syntactic and semantic rules in sentence production. It is not yet clear what the implications of their position are for language acquisition theory and research. These new insights had not yet become widely available when the research reported here was begun, and it has therefore been influenced mainly by the theoretical stance of Chomsky's proposals in Syntactic Structures (1957) and Aspects of the Theory of Syntax (1965).

Implications

As will be noted below, previous research on language acquisition has not been very insightful regarding theoretical descriptions of children's language, nor have its findings been easily applied to the practical language development and remediation problems of practicing classroom teachers of deaf children. We believe that this is largely because the theoretical rationale underlying all studies prior to the advent of transformational grammar accepted two notions which recent theory and research have shown to be inadequate for the task of describing language and its acquisition.

1. Both linguists and psycholinguists, once the artificial, prescriptive paradigms of traditional grammar had been overcome, remained tied to behaviorist/structuralist models which accepted as viable only such data as could be empirically gathered under specified replicable conditions. Hence they could not take into account the underlying knowledge of language which a speaker-hearer uses to process sentences. For example, given two sentences _Jeffrey hit the ball_ and _The ball was hit by Jeffrey_, a structuralist representation would convey only the type of surface information embodied in trees 5a and 5b, with no reference to a deeper level of semantic relationship, thus failing to capture the close relationship between the active and passive versions. Similarly, a surface structuralist analysis of _The shooting of the gangsters frightened me_ would break the surface sentence into its constituent parts (The shooting of the gangsters--frightened me; and so on down), but only one analysis would be possible, despite the clear ambiguity of the sentence. Also,two sentences like 7a and 7b are analyzed in exactly the same way in such a framework:

(7a) Herman asked Hermina to yodel.

(7b) Herman promised Hermina to yodel.

Any native speaker will readily recognize that the internal relationships are different; in sentence 7a it is Hermina who is expected to yodel, whereas in sentence 7b Herman will do the yodeling.

Previous methods of teaching syntax to deaf children have often involved an inventory of sentence "frames" or category orders of the structuralist type, into which words are inserted; the Fitzgerald Key (1956) is one such system which has been widely used. While such systems have their place, they cannot account for the facts of language competence. An overall view of deaf children's language as a whole, in which interrelationships of all its parts are displayed, is possible only by means of a different, deeper and more complete type of analysis.

2. In the past, linguists and psycholinguists also accepted the notion that children's language should be explained in terms of erroneous deviations made in attempts to reproduce the

language of the adults they heard around them--deviations due to inherent childish cognitive limitations on attention span, memory, and so forth, or to more specific disabilities such as deafness. Even in adult speech, certain dialects were considered to be "Standard" and others "Substandard," with the claim often being made that "Substandard" dialects like Black English were disorganized and haphazard in their structure, presumably because of the cognitive inferiority of their speakers. More recent linguistic and sociological research has shown such claims to be totally unfounded; all dialects spoken by normal adult speakers are equally "grammatical" and "logical," and equally efficient in their own context; no one is inferior to another, although social judgments have resulted in some being a liability in formal situations. Standard English is not "better," but "more appropriate" in such situations.

Recent psycholinguistic research with hearing children, as will be shown in chapter 2, has demonstrated that the language of young hearing children has a structure of its own, is internally coherent, and can be described by means of syntactic "rules," just as can the language of adults. While these rules differ from those of adults, they apply in a systematic fashion, approximating more and more through time, the rules of English comprehension and production used by adults. The child is not "making errors"--he is (in most cases) producing what for him are perfectly grammatical sentences from his own child's grammar.

Traditional methods of correction of these "errors" involve the scanning of children's sentences for omissions, insertions, and redundancies, and then molding the sentence into a frame and pointing out to the student any mismatches. Again, this type of analysis does have its place but its limitations as a comprehensive diagnostic and corrective method are many. First of all, it seems to lead to what van Uden (1968) has called "baked sentences," and to stifle the kind of creativity that is needed for a child to be fully at home with a complex language. Second, and probably more importantly, it fails to recognize the operation of consistent rules in the child's own particular dialect of English. Also, a forced word order analysis (such as the Fitzgerald Key, 1956) in its failure to recognize similarities between objects which are superficially different, is forced to consider a particular sentence frame as an isolated phenomenon, whereas in fact several such errors may be closely related, and correctible much more efficiently through a general, all-inclusive corrective algorithm. In fact, an attempt to correct one deviancy while ignoring other related ones is likely in many cases to be fruitless, and in some cases may result in negative influences on the overall structure of the grammatical system of the child.

Transformational grammar offers hope in all of the above areas. While considering each dialect of English to be perfectly legitimate "language" in its own right, it provides means for determining all structural relationships within sentences and for explaining structural synonymity and ambiguity. Most important of all, perhaps, is the fact that a transformational view of syntax can help to make some sense of a multitude of deaf children's errors which may, at first glance, appear to be essentially random and unstructured. The indication is that deaf children do have their own system of "rules" for producing some sentences.

For example, suppose a student produces the following sentence:

(8a) John kicked Bill and bit him back.

At first glance, it seems (at least in the absence of additional context) as though sentence 8a might simply be ungrammatical as the result of an unnecessary word back. If the teacher were to instruct the offending student to leave out the back, the result would, of course, be a good sentence.

(8b) John kicked Bill and bit him.

The problem is that the standard meaning of sentence 8b is likely entirely different from the student's intended meaning for sentence 8a, which probably means to him:

(8c) John kicked Bill and Bill bit him back.

Evidence will be presented in later chapters for a rule of Object-Subject Deletion, common to many deaf students, which deletes the subject of the second element of a conjoined sentence if it is identical to the object of the first; if one recognizes the existence of such a rule, sentence 8a is exactly what might be expected from a deaf child to express the meaning of sentence 8c. And it is clear that a sentence like 9a below does not demonstrate a randomly different type of deletion, but a related rule of Object-Object Deletion which deletes an object in a second sentence on identity with the object of the first.

(9a) Mary kicked Bill and she hurt.

Furthermore, we might note that pronominalization would normally apply in these sentences to give, in Standard English:

(8d) John kicked Bill and he bit him back.

(9b) Mary kicked Bill and she hurt him.

It is clear, then, that there is a close relationship between these two types of deletion on the one hand and pronominalization on the other; deletion is applied by deaf children in some of the same environments as Standard English pronominalization, and probably for the same reason--to avoid the redundancy of repeated elements in the sentence. This indicates that not only should the two types of deletion be considered together in any attempt at correction, but that the teacher might more effectively accomplish his goal if he includes pronominalization in his discussion. Such an approach will be much more fruitful than the traditional one of considering sentences 8a and 9a to be two isolated instances of "deletion errors."

We hope to demonstrate that an approach to deaf children's language, not in terms of "errors," but in terms of strategies (rules) that these children are using at various stages of their development, will provide greater insight into their language understanding--insights which may prove fruitful for developing better programs of language development and remediation for deaf pupils. This study presupposes that although the written langauge of deaf persons may appear garbled or stereotyped in structure, it is nonetheless generated by a grammar of rules, as are all natural languages, and that the rules can be described within a transformational framework. Such a description, being much more explanatory than previous ones, considers the individual's language system as a whole and should lead to more effective language teaching.

CHAPTER 2

PREVIOUS STUDIES OF LANGUAGE ACQUISITION

In order to understand more fully the relationship of the present study to previous studies of language acquisition, and to form a basic concept of the nature of child language as a starting point for discussion of the project results, we summarize here some of the more important past studies and their findings. This chapter will present first, research on the acquisition of language by hearing children, both "traditional" research and that based on more recent linguistic theory; and second, similar research on language acquisition by deaf children.

Hearing Children

Early research on the acquisition of language by hearing children has been extensively reviewed by McCarthy (1954). These early studies had the nature of straightforward descriptions and have provided later researchers with information on the first "sounds" the child makes, the first words he uses (and their average times of occurrence), and the growth of vocabulary. Studies of articulation and sentence structure were conducted, but the child's "errors" (articulation errors and incomplete and ungrammatical utterances) were regarded as a "problem," not a source of information about the acquisition of language. Also reported by McCarthy is a considerable literature on environmental effects (institutionalization, social class differences, multiple births, bilingualism, and specific experiences) and the interaction of language with other aspects of development (motor, intellectual, and social). Again, the data are descriptive, as opposed to explanatory, and the research seems atheoretical. Little effort was made to formulate and test hypotheses, and as a consequence, no clear picture of the language acquisition process emerges from the data.

In contrast, during the 20 years since McCarthy's review, researchers have proposed a number of theoretical formulations to explain a relatively small amount of data. Researchers are now focusing on the "how" of language acquisition, not just the "when."

Recent Theories

Recent theories of language acquisition may be loosely grouped into three categories: behaviorist, nativist, and cognitive. Each theoretical position will be reviewed briefly, then an overview of some of the basic data on language acquisition will be presented.

The behaviorist theories of language acquisition have their roots in the traditional psychology of learning. Skinner (1957) has presented perhaps the most comprehensive of the behaviorist theories. In this theoretical formulation, language is described as a network of associations, a large number of stimulus and response connections. Language is acquired through operant conditioning and reinforcement, and extended to new situations through response generalization. For the behaviorist theorists, language universals are those laws of learning which have long existed in psychology and which are believed to explain all learning. Structural linguistics, which developed during the period of logical empiricism, is closely associated with behaviorism.

The behaviorist theories have been attacked by Chomsky (1957), Weksel (1965), among others. The basic criticisms are that reinforcement and generalization are inadequate to explain the data, that language is too variable for the child to learn the appropriate connections, that language is essentially creative, and that what the user of language has available is an infinite number of possible utterances. These writers argue that if the child learned language in a stimulus-response fashion, in a lifetime he could never acquire all of the sentences which he is, in fact, capable of producing, including novel utterances of the type discussed in chapter 1.

An alternative to the behaviorist approaches comes from linguistic traditions, especially the ideas of Chomsky and later transformationalists. Proponents of this theoretical viewpoint place heavy emphasis on an innate biological propensity for language which exists in every individual. Lenneberg (1967) proposes that language develops as a maturational process of the neurological structures. McNeill (1966) emphasizes the nature of exposure to language, and theorizes that speech sounds are distinguishable from other sounds in the environment, that linguistic input can be organized into categories, and that the developing linguistic system undergoes constant reevaluation. The claim is made that, because of the innateness of the propensity for language, there are language universals common to all men and languages. The primary criticism of the nativist theories has been that there is little physiological evidence to support the biological-neurological organization proposed by the proponents of the theory. The language acquisition device they describe is hypothetical, with no basis in known biological data.

The third position falls intermediate between the two extremes of the pure behaviorist (for whom everything is learned) and the pure nativist (for whom everything is innate). This theoretical view may best be described as "cognitive." Slobin (1966a & 1966b), Fodor (1966), and Bever (1970) are recent proponents of this position, while Piaget may be viewed as an early proponent. The cognitive theorists emphasize the interaction between a biological predisposition to use language and the environment. The development of the cognitive ability to deal with the world, the limitations of the memory in short term and long term retention, and the mechanisms for processing information place limits on the rate of language acquisition. Language functions as a means of communicating information and depends on the general cognitive development of the child for its development. Because of its rejection of behaviorist claims, this position is compatible with transformational grammar and has been espoused by many transformationalists.

Traditional Studies

Working from a traditional/structuralist viewpoint, Harrell (1957) studied the oral and written language of school-age children. His subjects ranged from 9 years to 15 years; all were white and spoke English. The children watched a film, then told (or wrote) a story about the film. Harrell found that oral stories were longer than written stories and that both types increased in length with age. Girls tended to write longer stories than boys, but boys' oral stories were longer than girls' oral stories. Both the number of subordinate clauses and clause length increased with age, with greater increases for written than for oral.

Loban (1963), also working within a structuralist framework, conducted a longitudinal study of children's language abilities, following the same children from kindergarten through high school. His subject population was divided into a high ability group and a low ability group. Segmenting language into what he called "communication units" (see Strickland, 1962), Loban found that the increase in number of communication units and number of words per communication unit was steady and clearly marked for the high ability group, but for the low ability group the increases were smaller and some regression occurred. Object complements were used only by the most capable subjects and indirect objects rarely appeared. Use of conditional, hypothetical, and suppositional expressions was made only by those subjects with the highest ability. For all subjects, adverbial and nominal clauses were used more than adjectival clauses.

Generative Grammar-Influenced Studies

One of the most consistent findings of the generative grammar oriented research on the language of young children has been that at about 18 months of age children produce two-word utterances, which appear to be "grammatically" consistent, not with adult grammar, but with the child's own internal grammar. Braine (1963b) has described the grammar at this stage as consisting of two classes of words: pivot class words (e.g., allgone, my, off, come, other) which always occupy the same position in the utterance (a word is either a first position word or a second position word, not both) and *open class words* (e.g., *mommy*, *shoe*, *light*, *man*, *car*), each of which may occupy either position in an utterance. This produces three sentence types in the child's two-word grammar: pivot-open (*my mommy*, *allgone shoe*), open-pivot (*light off*, *shoe off*, *Mommy come*), and open-open (*man car*, *car bridge*). More recent work, such as that of Bloom (1970), has criticized pivot-open grammars as simply describing the surface structure, not the underlying semantic relationships, particularly when describing the open-open constructions. Bloom has shown that in order to fully understand such two-word grammars, the function (or purpose) of the utterance must be considered as well as its form.

Following the stage of two-word utterances, the first hierarchical constructions (i.e., with smaller units embedded in larger, higher units) occur. Both Braine (1963) and Brown and Bellugi (1964) provide evidence that noun phrases function as embedded sentence constituents at the three-word stage. Braine's data provide examples of an open-open construction (*man car*) being expanded by inclusion of a pivot-open construction (*other car*) to produce the sentence *man other car*, meaning *The man is in the other car*. This sentence has a hierarchical structure, since *other car* functions as a noun phrase which is equal in status to *man* (i.e., this is not a simple string of three equal words). Brown and Bellugi have found additional support for the existence of the noun phrase in the replacement of the noun phrase by a pronoun by some children. For example, *Mommy get my ladder* can be changed to *Mommy get it*, indicating that *my ladder* is a constituent noun phrase.

The over-regularization of inflections is a third striking feature of children's language. For example, children who have used the correct past tense of irregular verbs (*went*, *did*, etc.) will, after a few exposures to examples of regular verbs, regularize all past tense forms, thus producing *goed*, *doed*, etc. And these regular forms persist for some time in the child's language.

Although the acquisition of grammatical transformations in the language of young children has not been investigated to any great extent, the work of Klima and Bellugi-Klima (1966) on the development of negation and question formation does provide some information on that grammatical process. Initially, a positive utterance is made negative by adding a negative element (usually *no* or *not*) at the beginning or at the end of the utterance. (e.g., *No singing song*). At a later stage of development the negative is brought inside the sentence (e.g., *That no fish school*) and the auxiliaries *can't* and *don't* are used. At the same time, questions of the form *Why not* + sentence (the sentence may be either positive or negative) (e.g., *Why not he eat*? *Why not me can't dance*?) appear. Following this stage, an increasing number of utterances resemble adult forms, although negative questions still differ from adult forms in that Subject-Auxiliary Inversion has not taken place. (Subject-Auxiliary Inversion is that rule which, in certain types of questions, inverts the order of the subject and auxiliary verb--e.g., He can dance becomes Can he dance?)

The research on the language acquisition process of early childhood has led many investigators to conclude that a child at about age five years has acquired most of the basic grammatical structures of English. However, more recent research with children of school age has revealed that many important syntactic developments occur much later than that (C. Chomsky, 1969). Of particular interest in the present study are those investigations which deal with the written language of children.

The studies of Harrell and Loban have already been discussed. The first research to apply a partially transformational analysis to the written language of children was that of Hunt (1965). He gathered writing samples of 1000 words (produced in the course of regular school work) from fourth, eighth, and twelfth graders. Hunt was dissatisfied with sentence length as an indicator of syntactic maturity because the youngest subjects produced very long sentences through their poor punctuation skills and their fondness for main clause conjunction (most often by using and). Thus Hunt defined the minimal terminable syntactic unit (T-unit) as "one main clause with all the subordinate clauses attached to it." He found a steady, statistically significant increase in mean length of T-units from grade level to grade level.

Hunt was particularly interested in sentence-combining transformations. He found steady and significant increases in the use of adjective clauses, those with a relative pronoun or relative adverb and which modify nouns, as well as an increase in the use of noun clauses, particularly as subjects, objects of prepositions, and predicate nominals. He also found a shift away from direct discourse as the students' language matured. Fourth graders used adjective, noun, and adverbial clauses correctly, but simply did not produce as many as did the older students. The increase in use of subordinate clauses was accompanied by a decrease in the use of coordination. The older students in Hunts' study produced longer nominals than the younger students because they used more modifiers. They also used more nominalized verbs. These "near-clause" nominals are, Hunt believes, one of the most important indicators of syntactic maturity. The use of non-clause adverbials tended to decline with increasing grade. Use of auxiliary verbs increased with age, but Hunt's data suggest that main verbs are not useful indicators of syntactic maturity for school-age hearing children, as even the fourth graders freely produced all verb types.

Following from this initial work of Hunt, a study by O'Donnell, Griffin, and Norris (1967) investigated the oral and written syntax of kindergarten and elementary school children. Thirty children were tested at each of six grade levels: K, 1, 2, 3, 5, and 7, each grade having approximately equal numbers of boys and girls. Each subject watched two short cartoons of Aesop's fables. After seeing a film, the child was asked to tell the story to the interviewer and then to answer some preplanned questions. Children in the 3rd, 5th, and 7th grades also wrote their stories and their answers to the questions after they had finished telling their stories to the interviewer.

The findings of O'Donnell, Griffin, and Norris generally agreed with those of Hunt, in terms of length of T-units and number of sentence-combining transformations. In both speech and writing fifth graders used the greatest number of sentence-combining transformations. These investigators suggest, however, that deletion transformations (those which delete elements from sentences--e.g., You go home! ⟹ Go home!) may be better indicators of syntactic development than are subordinate clauses. Their analysis of the structural patterns of main clauses revealed that only kindergarteners and seventh graders used all clausal patterns, that S-V (Subject-Verb: He sleeps) and S-V-O (Subject-Verb-Object: He eats yogurt) patterns accounted for 80% of the T-units in K-2nd, and 85% in 3rd-7th grades (for speech and writing). The S-V-predicate adjective (He is old) pattern in writing increased from the 5th grade to 7th grades, while the S-V-O pattern decreased at the 7th grade. The data strongly support the conclusion that in the higher grades, advances in control of syntax shown in writing are much greater than those shown in speech.

Deaf Children

While earlier studies of hearing children suffered from the drawback that child language was not analyzed as an entity in itself but rather as a deviant and incomplete (and relatively haphazard) form of adult language, research on deaf children has been based on the premise that not only is their language deviant with respect to the language of adults, but that it is deviant also with respect to that of "normal" hearing children. Even after it had been shown that the language hearing children use is systematic and can be described without reference to adult grammar, deaf children's language was still assumed to be mostly idiosyncratic and haphazard, and explicable only in comparison to that of "normal" users of the language. Nevertheless, theoretical developments in linguistics and psychology have influenced these studies, as they have those of hearing children, and research on deaf children's language at a particular period has generally followed that for hearing children at the time.

The present survey views studies of language acquisition of deaf children as falling into four categories: those which use

Free or Controlled methods of data collection (Cooper and Rosenstein, 1966), with either Traditional Grammar or Generative Grammar methods of data analysis and description. Although dividing lines between the categories are seldom distinct, an attempt has been made to provide representative studies of each of these four types of analysis as used with deaf children.

Controlled Traditional Grammar Studies

According to Cooper and Rosenstein, controlled studies are those in which the investigator, in collecting his data, "attempts to control or manipulate the behavior of his informant by holding certain linguistic variables constant." In free studies, in contrast, the data analyzed are obtained from a freely produced sample of speech or writing. Almost all traditional studies of the controlled type have compared the performance of deaf and hearing children on standardized achievement tests. Fifty years of work in this area were summarized by Cooper and Rosenstein (1966), who noted that studies had found that the reading comprehension skills of deaf 18-year-olds and adults rarely rose above those of the average fourth-grade hearing child; that their vocabulary skills were also at about the fourth-grade level; that their scores on grammatical usage subtests were at about the same level, but were inflated by relatively good performance on the visual skills of spelling and punctuation, and by avoidance of "errors" frequently committed by hearing children because of informal oral usages (ain't, etc.); and that even some of the academically superior deaf students (Gallaudet College entrants) at 19 years of age, after 13 or so years of schooling, had a median vocabulary score at the sixth-grade level and a median paragraph meaning reading comprehension level of the seventh or eighth grade (Fusfeld, 1955). Recent results of the largest study to date of the achievement of deaf students confirm these findings (Di Francesca, 1972). Approximately 17,000 deaf students across the United States were given an appropriate level of the Stanford Achievement Test under carefully controlled conditions. Deaf students did very poorly on those tests concerned with the understanding of language. As an example, on the Paragraph Meaning reading subtest, deaf students progressed only from a grade level of 1.6 at 6 years of age to 4.2 at age 18--a gain of only 2.6 grade levels in 13 years, an average of 0.2 grade levels per year. Strikingly, only 5.3% of the 18-year-old deaf students reached the 75th percentile for their age on this subtest.

These United States findings are confirmed by research in other English-speaking countries. Wollman (1964) found severely prelingually deaf children in Great Britain to have more than twice as many simple sentences (one subject and one main verb--The baby is sleeping) in their written productions as did hearing children of the same age; half as many compound or conjoined sentences (formed from two or more simple sentences of equal importance joined by and, or, or but--e.g., The baby is sleeping but his sister is awake); one-third as many complex sentences (composed of a main sentence in which is embedded one or more subordinate ones--e.g., The baby slept when he was tired); and fewer than one-fifth as many compound/complex sentences (e.g., The baby slept when he was tired, and his sister played). On a vocabulary test which consisted of naming familiar toys, 6-year-old British deaf children did not perform as well as 2-year-old hearing children (Owrid, 1960). In the understanding of connected speech, Owrid's deaf subjects of 8 years of age still performed considerably below 2 to 3-year-old hearing children; and these 8-year-old deaf children achieved scores only half as high as those of 2 to 3-year-old hearing children on a test of their ability to use their speech effectively.

Power (1968) reported children from an Australian school for deaf students to be up to six years retarded on a standardized reading achievement test and noted that their inferiority steadily increased with age. Almost identical results have been reported from New Zealand schools for deaf students (S. Bartlett, personal communication to Power, 1969).

Moores (1967) tested deaf students using a Cloze procedure. In the Cloze technique, subjects are presented with passages of prose with every nth word deleted. They are required to insert what they consider to be the appropriate word. Several indices of various aspects of langauge comprehension may be derived from the results. Moores was able to demonstrate, using this technique, that even the low scores on standardized language and reading tests are inflated measures of deaf children's understanding of complex syntactical structures. He compared two groups of hearing and deaf children matched on reading skills as measured by a standardized achievement test and found the deaf group still to be significantly inferior to the hearing group on Cloze scores said to be indicative of vocabulary level and ability to comprehend complex syntax.

In a somewhat different study, O'Neill (1973) found that deaf children were inferior in their comprehension of simple "base structure" rules of grammar (word order, redundancy, omission and selectional restrictions) to younger hearing children equated for reading age. She concluded "There is a strong indication that reading grade equivalent scores for deaf and hearing children should not be equated. School personnel must be aware that a reading score achieved by a deaf child does not insure his success in the use of materials appropriate for hearing children at the same reading level (p. 116)."

Both Moores' and O'Neill's studies support the contention that standardized reading tests give spuriously high estimates of the language comprehension of deaf students, even though those estimates are distressingly low in comparison to hearing students.

Teachers of deaf children have usually contended that "it is easier to teach vocabulary than connected language" (i.e., sentence structure). While this may be true, it does not seem that, at least as far as standardized test results are concerned, deaf children's vocabularies are superior to their understanding of written connected language. Studies have consistently shown that scores on *Vocabulary* subtests of achievement batteries are not usually higher than those on subtests with such labels as *Paragraph Meaning*, and they have frequently been reported to be lower (Cooper & Rosenstein, 1966; O'Neill, 1973). These findings are confirmed by the largest achievement test study of deaf students to date, using the *Stanford Achievement Test* (Di Francesca, 1972). It was reported that *Vocabulary scores* were below those for *Word Meaning* and *Paragraph Meaning* at lower age levels, and *Word Meaning* scores were consistently below those for *Paragraph Meaning* even at the oldest ages studied.

Free Traditional Grammar Studies

Typical studies in this area consist of the analysis of a corpus of utterances. These utterances may be obtained from one or a number of children either "naturalistically" (usually by tape-recording utterances in a play situation or in the child's home environment), or in response to stimuli which may consist of orally presented stories, still pictures, or movies. With these latter the child may either be asked to tell his story to a recorder or to write it. Most studies of deaf children have used written language samples because of the difficulty of interpreting from tape recordings the speech of prelingually deaf children.

Analysis of typical samples of "free" language production shows that deaf children perform just as poorly in this mode as they do on language comprehension tasks. Many studies have demonstrated deaf children's inferiority to hearing children of much younger ages, and the great extent to which deaf children's language performance as exemplified in their written productions differs from that of Standard English. According to Cooper and Rosenstein (1966), this work can be summarized under several headings.

Productivity. The extensive analysis of Heider and Heider (1940) indicated that although their deaf subjects' compositions did not differ in total length in words from those of hearing children of the same age, the average length of single sentences was strikingly shorter than that of hearing children. Deaf children did not attain the average sentence length of 8-year-old hearing children until they were 17 years old. These results have been confirmed by Simmons (1962) and Myklebust (1964).

Complexity. Heider and Heider (1940) found that their deaf subjects were typically 17 years old before they used the same proportion of compound and complex sentences in their compositions as did 10-year-old hearing subjects. They were similarly developmentally retarded in their use of subordinate clauses of all types. In 1965 Hunt introduced a new "summary index" of language complexity in his T-unit ("one main clause plus all the subordinate clauses attached to or imbedded in it," page 141). In a major study Taylor (1969) repeated Hunt's analysis on a corpus of writing of deaf children. She reported that several of Hunt's indices based on the T-unit (mean number of clauses per T-unit, mean T-unit length, and so forth) showed significant increases in the writing of deaf children from grade to grade, and confirmed several of the findings of previous "traditional index" studies. Part of Taylor's analysis was repeated by Marshall and Quigley (1970), who reanalyzed the corpus of writing collected by Stuckless and Marks (1966). They generally corroborated Taylcr's findings about various T-unit indexes being sensitive indicators of maturity of language expression in deaf children to the extent that they showed significant increases over time. Somewhat suprisingly, they also found that the more traditional subordination ratio (number of subordinate clauses per main clause) to be just as good an indicator, but felt that T-unit analysis was more useful educationally, because the internal structure of the T-unit was more easily examined to determine the factors which contribute to its maturation.

The most extensive study designed to establish developmental indexes of language production phenomena in deaf children was that of Stuckless and Marks (1966). They used mean teacher ratings of the "goodness" of compositions written by deaf children in response to a picture series as the criterion variable to establish a multiple regression equation. This equation used the objective predictor measures of composition length, type-token ratio, and a grammatical correctness ratio (based upon the number of correctly used words in the first 50 words produced by the child). Despite some reservations as to the objectivity of the grammatical correctness ratio, this would appear to be a useful "summary index" of deaf children's written language developmental level, though, as the authors pointed out, the large standard errors of estimate at various ages make it useful only for studying large groups of subjects. Norms of written language development were produced for children between the ages of ten and eighteen years.

Flexibility. It has been claimed that deaf individuals have a relatively rigid style and use many stereotyped repetitions in their written language. This claim was supported by Myklebust (1964), who found that deaf children use a much greater percentage of "Carrier Phrases" (I see a...; There is a...; etc.)

than do hearing children of the same age, although this finding may be partially due to Myklebust's use of only one stimulus picture containing a number of different objects. This inflexibility of language was also reflected in Simmons' (1962) finding of a much lower type-token ratio (TTR) in the written language of deaf than of hearing children. The TTR is the ratio of the number of different words to the total number of words in a language corpus, and is considered to be a measure of vocabulary diversity. In an extensive longtitudinal study of deaf pupils in Benelux and United States schools, Tervoort (1967) found that the TTR increased with age, indicating increasingly flexible use of language. Categories which contributed most to this improvement were nouns and function words, with verbs, adverbs, and adjectives contributing less to his deaf subjects' increasing verbal sophistication. Simmons also found that deaf children in her sample all tended to use the same phrases. She cites the example of They had an idea used in 50 of 52 essays she examined. Outstanding also was her subjects' tendency to use adjectives only in predicate positions (I see a car. The car is red), whereas hearing children used them both as predicates and as modifiers (I see a red car). It has been argued (van Uden, 1968; Tervoort, 1967) that this stereotyped use of a limited number of phrases is due more to the effects of formal "constructivist" teaching methods than to any effect of deafness per se on language acquisition.

Distribution of Parts of Speech. Both traditional classifications of parts of speech (Myklebust, 1964) and Fries' (1952) structuralist based word classes (Simmons, 1962) have been used in this type of analysis. Both Simmons (Fries' classes) and Myklebust (traditional categories) found systematic differences in this area between deaf and hearing children. In general (using traditional terminology) deaf children use more determiners, nouns, and verbs than hearing children and fewer adverbs, auxiliaries, and conjunctions.

For pedagogical purposes of curriculum construction and development of language teaching methods, the four types of studies reported above have been of limited value. An attempt to meet pedagogical needs is usually made in terms of a developmental analysis of the kinds of "errors" typically made in written language by deaf children.

Kinds of Errors. Two studies representative of much work in this area are those of Perry (1968) and Myklebust (1964). Both authors presented pictures to samples of deaf children and asked them to write compositions about the pictures. Both analyzed the errors made in these compositions under roughly the same rubric. They reported that deaf children made errors of addition (of unnecessary words), omission (of words needed to make the sentence correct in Standard English), substitution (of wrong words), and order (with word order of their sentences departing from that of

Standard English). The great impact of severe deafness on language development is demonstrated by the consistency of the findings between the two researchers. Myklebust in the United States and Perry in Australia each found that the most frequent errors made by deaf children were those of omission, followed by substitution, addition, and order errors. Neither author provided a detailed analysis of the kinds of errors in the various categories, or the implications of these errors for syntactic structure.

In summary, there is substantial support for Cooper and Rosenstein's (1966) conclusion that

> ...deaf children have been found to be markedly retarded in their achievement test scores. Their written language, compared to that of hearing children, was found to contain shorter and simpler sentences, to display a somewhat different distribution of the parts of speech, to appear more rigid and more stereotyped and to exhibit numerous errors or departures from Standard English use (p. 66).

Free Conversational Studies

One of the most interesting and thorough studies of the language of deaf students has been reported by Tervoort (1967). This study is unique in that (a) it followed the same group of children over a six-year period, (b) it analyzed the total communication pattern of the children in private, informal conversation (whether that communication was in speech, sign language, fingerspelling, non-systematic gesture, or any combination of these), and (c) it compared English-speaking deaf students from two United States schools with deaf students from Dutch and Flemish/French-speaking European schools. Tervoort's method was to film conversations between two children once each year, using a telephoto lens so as to intrude as little as possible into the scene. Hence his data were gathered under relatively "free" conditions.

Tervoort's analysis was largely based upon structuralist grammar notions, although presented in such detail that useful information of the type to be presented here (following transformational generative grammar theory) could well be extracted from it. In general, Tervoort found that deaf children from the United States schools eventually approached closer to their target language than did those from the European schools. The findings reported here are based upon only the English-language data.

Tervoort found that deaf students increased in the number of correct English sentences they produced from 10% at age 7 to 69% at age 17--with an overall percentage correct of 48. Of these correct sentences at age 17, 49% were simple sentences, 10% were "inverted" sentences (mainly questions), and 10% were "complex" sentences (mainly sentences conjoined by and). He felt that these deaf students showed undue attachment to simple sentences and attributed that, at least in part, to considerable use of the Fitzgerald Key by the United States schools.

Tervoort also analyzed several aspects of the "incorrect" sentences produced by his subjects. As in most previous research, the major categories into which errors fell were omissions, order, redundancy, and substitutions. His use of natural conversation rather than written materials is probably reflected in his finding of omission of sentence subjects (both nouns and pronouns). Other research has commented upon the fact that subjects are hardly ever deleted in writing. Tervoort also found omission of both main verbs and copulas to be relatively frequent, and less frequently omissions of determiners, prepositions, conjunctions and other minor categories also occurred.

Order errors were relatively frequent in incorrect sentences, and it may be that this reflects the impact of sign language syntax upon deaf children's attempts to speak in English. A number of redundant uses of prepositions, adverbs, articles, and conjunctions were also found. Tervoort also makes the interesting observation that an increase in general grammaticality is accompanied by increase in "small errors."

Free Generative Grammar Studies

The 1960's saw the beginning of a new series of analyses that was more concerned with intra-sentence and intra-clause phenomena and with explicating the rules that children use to produce sentences at various developmental levels. The notion of the "generativity" of sentence processing is central to these new developments. The idea of language being "generative" refers to the fact that there is a limited number of highly abstract mechanisms used (at a subconscious level) for the processing (comprehension and production) of a theoretically infinite number of sentences. These abstract mechanisms are often described in terms of "rules" for sentence processing (production or interpretation). (Surveys of modern approaches to language acquisition and processing in children will be found in McNeill, 1970; Menyuk, 1971; Ferguson & Slobin, 1973, as well as in chapter 1 of this report.)

Both the old and the new approaches are found in the transitional work of Hunt (1965), whose research has already been discussed in the Generative Grammar-Influenced section. Hunt was concerned not only with providing a more valid "traditional" measure of language maturity (his "T-unit"), but was also concerned with describing intra-clause phenomena such as complementation, nominalization, and so forth. He described systematic changes in these phenomena with increasing age and considered the major process at work to be one of "consolidation" of grammatical structures. Consolidation consists of the incorporation of a number of simple sentences into a complex sentence via conjunction, and more importantly, via processes such as complementation and relative clause formation, which embed one or more simple sentences within another to make a complex sentence, producing, for example, I saw the boy who stole the car from I saw the boy. The boy stole the car. Hunt concludes,

> The older student can incorporate and consolidate more grammatical structures into a single grammatically interrelated unit. The younger student produces short separate units. His span of grammatical concern or attention is narrow. As he matures that span broadens, so he casts the net of consolidation over larger and larger bodies of material. As he consolidates, he also discards needless words. His redundancy lessens and his succinctness gains. Unless we suppose that there is less thought per word in the writing of older students, we must suppose that as students mature they learn to incorporate a larger and larger body of thought into a single intricately related organization (pp. 143-144).

We have noted that both Taylor (1969) and Marshall and Quigley (1970) analyzed deaf children's language using the traditional aspects of Hunt's techniques. Both these studies also concerned themselves with intra-clause and intra-T-unit development. They attempted to find phenomena internal to language structures that changed significantly over time in the written language of deaf children. Marshall and Quigley demonstrated that some intra-clause phenomena increase in frequency of use most from 10 to 14 years of age (genitives, personal pronouns), others after 14 years (present participles, linking verbs, adjective clauses), while still others showed steady increase over the entire age range from 10 to 18 years of age (gerunds, past participles, infinitives), or fluctuated erratically (auxiliaries). They pointed out that the educational uses of these findings are slight. Again, it could be argued that this was because the method of analysis they adopted was unable to relate fluctuations in the acquisition of these intra-clause phenomena to the generative principles which govern their occurrence. One might hypothesize, for example, that the erratic fluctuations in the development of use of auxiliary verbs could be related to deaf children's gradual adoption by stages of more and more complex rules for passivization, conjunction, and embedding of sentences.

Along with the traditional "quantitative" analysis reported previously, Taylor (1969) also pioneered a kind of analysis new for deaf children's written language. One way of looking at the components of a grammar for expository convenience is to divide them into four types.

Phrase Structure Rules, which operate to rewrite symbols to produce the deep structure of sentences; for most non-technical purposes, the product of these rules can be seen as having the structure of one or other of the "simple" or "kernel" sentences of English (Cattell, 1969). These rules are violated in such sentences as Ran the girl home (an order violation), The boy to the park (an omission violation), and The boy ran to home (a redundancy violation).

The Lexicon, the speaker's subconscious listing of words and their characteristics--for practical purposes, roughly equivalent to a dictionary. The lexicon also includes components specifying selectional restrictions, i.e., rules which specify which classes of words can co-occur with others and thus bar the creation of sentences like The rock sang an aria; and categorial rules which specify the functions of words in sentences and which categories of words may co-occur in certain sentence environments (rules violated for instance in such sentences as, The boy said a sad, where an adjective is used in noun phrase position) or which specify whether certain nouns must be preceded by a determiner (violated in The man bought car).

Morphological Rules, dealing mainly with inflections of nouns, verbs and adverbs; the morphology is not considered by transformationalists to form a separate grammatical component; its functions are generally divided among the other components. However, morphological processes can be practically grouped and studied independently with no negative theoretical consequences. Inflectional rules (those which concern the addition of endings to words, especially verbs, to express grammatical relationships) are violated in a case like The boy ranned home; derivational rules (rules which typically change a word of one class to a word of another class, as adjectives to adverbs) in, John is a happily boy.

Transformational Rules, which manipulate (move, delete, or insert) the products of the Phrase Structure Rules into surface structures which are the heard or seen expression of sentences. On the surface these may be either simple sentences or more complex ones constructed by conjoining two sentences or embedding one or more sentences inside another.

These four headings will be used in this review of previous research which has used transformational generative grammar theory as a model. Most of the research cited in this "Free" section is from Taylor (1969). In this major study, Taylor had 35 deaf children at each of four grade levels write compositions in response to their viewing of an 8-minute movie on Aesop's fable of The Ant and the Dove. The results reported here are from an extensive series of analyses which represent an advance over those analyses of deaf children's language undertaken prior to her work.

We have mentioned several times that the mere counting of omissions and other kinds of "errors" is not productive of linguistic or pedagogically useful insights into deaf children's language. Taylor does present an analysis of the "errors" her subjects produced, but there is a significant shift of emphasis in her work. She does not just catalogue the frequency of occurrence of omissions and other errors, she uses such phenomena to describe "the rules violated in the production of any deviant or non-grammatical structures (p. 45, emphasis added)." From the description of such non-Standard English rules in the language of deaf children thus begun by Taylor, one could eventually hope to devise programs of language development and instruction which might more efficiently help deaf children to move from their "non-English" language competence to a grammar that more accurately reflects that of Standard English.

Phrase Structure Rules.

1. Omissions. Taylor found four major omissions in the writing of her sample of deaf children: those of prepositions (The ant slept the bed), determiners, (The ant saw grasshopper), direct objects (A girl threw in the water), and verbs (particularly copulas) (The bird away). Determiner omissions were the most frequent at all age levels, followed by prepositions, direct objects, and verbs, in that order. However, at age 10 verbs were the second most frequent omissions. These findings were apparently confirmed by Kates (1972), who did not, however, give a detailed analysis of the types of omissions made by his subjects. By age 12 verbs had become the least frequent omission. This leads Taylor to suggest that one of the earliest Standard English rules mastered by young deaf children is that the predicate of a sentence must contain a verb; that is S ⟶ NP + VP,—a sentence must contain a noun phrase and a verb phrase.

The frequency of occurrence of all omissions decreased with age, indicating that deaf students gain increasing mastery over this aspect of sentence production. One exception to this trend was omission of direct objects; the number of such omissions dropped between ages 10 and 14, but increased considerably again between ages 14 and 16. Taylor was able to provide an interesting analysis of these fluctuations in terms of the environments in which direct object omissions occurred.

At age 10, almost all such problems were due to seeming ignorance of whether certain verbs were transitive or intransitive.

Many verbs which must take an object were frequently written without one by deaf children at age 10 "resulting in such constructions as the following: It put on the water, The ant bit, The dove dropped (p. 82)." At 12 and 13 years of age the commonest type of omission occurred in conjoined sentences where the second occurrence of an object was deleted, perhaps because of overgeneralization of the ability to delete some second subject NP occurrences on identity with an earlier occurrence. For example, in Standard English, both of the following are good sentences with the same meaning.

Mother bought the food and she put it in the car.

Mother bought the food and put it in the car.

The subject of the second simple sentence (She put it in the car) can be deleted because it refers to the same person as does the subject of the first simple sentence. For some deaf children, however, the following sentences are also equally good and equal in meaning.

The ant got the food and brought it to his home.

*The ant got the food and brought to his home.

In this case it is the object of the second sentence which is deleted on identity to the object of the first. This is not allowable in Standard English, and the * sentence above is ungrammatical. The rule which performs this deletion also operated widely in the samples analyzed by this project, and is referred to in this report as object-object deletion.

By 16 years of age, the older students made relatively few omissions in conjoined sentences, but their explorations of a complicated new sentence structure seemed to lead them into a new type of direct object omission. This occurred in embedded structures such as for-to complements: The ant got the tool to pinch instead of The ant got the tool to pinch the man.

This type of analysis is more informative than the simple counting of "errors" undertaken in the earlier studies. The previously inexplicable fluctuations in the omissions category in such studies as that of Myklebust (1964) can now be explained in terms of the type of sentence constituent omitted and the changing environments in which these omissions occur. With this type of analysis we are moving towards pedagogically useful information. Knowing the particular difficulties deaf students may have, teachers may be able to begin to develop tests to diagnose the occurrence of such problems in the children in their classes, and to concentrate on individualized programs of language development to help these children move closer to Standard English sentence structures. The fact that further analysis is still required, is, however, exemplified by the fact that Taylor felt that the three categories noted above could not fully account for the increase in occurrence of direct object omissions from ages 14 to 16.

2. Redundancy. Taylor found that the major type of redundancy in her data occurred with prepositions, in such forms as The ant walked to home and He thanked to the dove. The frequency of occurrence of such phenomena declined little over the age-range she studied. In comparing the occurrence of omissions and redundant use of prepositions, Taylor was able to discern a pattern of development which has been held to be typical of language acquisition in younger hearing children (e.g., Slobin, 1966a; Cazden, 1968): (a) the failure to apply a rule until it is learned, (b) the gradual acquisition of the rule and its increasingly correct use, (c) the subsequent "overgeneralization" of that rule to environments where it should not be applied, and (d) predominantly correct use. Data in the present project show that this sequence is indeed common in the process of language acquisition by deaf children, and that it can be detected in other types of redundancies in more complex language structures of older children.

3. Order. Taylor found order problems to be relatively infrequent in her sample. Such as there were occurred mainly at about age 10. She felt that the order of English syntax may have been mastered by most deaf children before this, the earliest age represented in her sample. It seems more likely, however, that this conclusion is an artifact of collecting written samples from external stimuli. Results from the present project indicate that order problems are quite frequent in deaf children's language competence, as exemplified in their performance with controlled testing on questions and passive sentences. Taylor's findings probably apply only to simple active declarative sentences.

The Lexicon.

1. The Dictionary. "Dictionary studies" of the language of deaf children have been largely confined to investigations of scores on vocabulary subtests of standardized achievement tests. Such studies have limitations which have been discussed in the section dealing with traditional "controlled" studies. Taylor has made an interesting beginning to a somewhat different approach to deaf children's knowledge of vocabulary. Following her analysis of selectional restriction errors, she notes that her subjects made many other word choices that were impossible to classify.

> Some appeared to result from incompatible semantic features, some from incompatibility between the word chosen and the events that transpired in the stimulus film, and some from the students' unfamiliarity with English idioms...
>
> Both types of word choice errors, those classified as selectional and those classified as other, appear to stem from the deaf child's lack of vocabulary control.

> Either the deaf child's vocabulary does not include certain lexical items and he is forced to make inappropriate substitutions, or else he has in his vocabulary items for which he has incorrect or incomplete information (p. 126).

2. Selectional Restrictions. Very little information is available concerning deaf children's violations of selectional restrictions. As noted previously, Taylor found her data in this area very difficult to interpret. Errors that could confidently be attributed to violation of selectional restrictions were very infrequent. The only two categories that appeared to be clear were "combinations of determiners and nouns which were mutually incompatible with respect to the feature (± count) e.g., a water and the few grass, or with respect to the feature (± plural), e.g., a scissors and a pliers (p. 124)." (Notice that for some speakers of Standard English the last two examples are grammatical because of reanalysis of the nouns as singular.) No discernible improvement in deaf children's performance in this area could be detected within the 10 to 16 year age range investigated by Taylor.

3. Categorial Rules. Deaf children in Taylor's sample made few substitutions of one major category of English for another, but they did not noticeably improve their performance in this area across the age range she studied. Taylor felt that sentences containing such phenomena were not grossly deviant, and could be readily interpreted by readers. She ventured the tentative hypothesis that deviant structures such as Mother table the food are akin to such "functional shift" use of "nouns" as "verbs" in such expressions as table the motion and so on.

Kates (1972) reports a study where deaf students were required to write a sentence in response to a stimulus word given to them (a total of 32 words was provided). He found the same as Taylor: "few subjects...made unacceptable functional shifts, that used one part of speech to perform the function of another (p. 45)."

Morphological Rules. Taylor found significant improvement with age in deaf children's ability to use correctly those kinds of morphological rules that she investigated. Most of the difficulties occurred in verb inflections, followed by singular-plural inflections and possessive inflections in that order.

Verb inflection difficulties followed typical patterns found in much younger hearing children (Cazden, 1968). The most frequent were omission of inflectional endings e.g., So she fly and get a leaf, followed by overgeneralization of the correct form, as The dove was scared and flied away, or incorrect application of the correct rule as in The circle broked. The least frequent of verb morphological deviancies occurred as incorrect tense marking in sentences like Dove saw ant can't swim (where Standard English would use couldn't).

Most singular-plural deviancies occurred in redundant use of the plural morpheme as in The sheeps went to sleep, followed by omission of the plural morpheme, Six boy went to the party, and use of such confused forms as The leave was on the tree. Taylor also found some confusion in her deaf subjects in the use of the possessive morpheme, i.e., 's and s'.

Transformational Rules. Taylor examined deaf children's use of three major types of transformational rules in her study. Compared with some other categories there were relatively few transformational "errors," but Taylor considered that this was not because deaf children performed well in this area, but because they, in fact, rarely attempted to use complex transformations. The students did not show a significant decline in the number of non-standard transformational structures they produced with age, but Taylor felt that they showed some increased mastery of transformational rules, because while the number of deviancies did not decrease, the number of transformations attempted did increase significantly with age.

Taylor examined three major transformational rules.

1. Conjunction. Attempts to join two or more sentences together using conjunctions (most commonly and) were the transformation most frequently found in Taylor's data. She found deaf children had two major problems in this area. The coordinating conjunction was often omitted, as in sentences like A ant see a tree a bird and Ant walk found animals; or misplaced, as in The dove got out of the tree and took a leaf threw it down. Many children placed a conjunction between every sentence conjunct, as in The ant ran to its home and get the scissors and hit a man's leg.

The other major problem deaf children had was in knowing what deletions were permissible in conjoined sentences. Taylor felt that many children operated thus:

> If the subject of a sentence is identical to any noun phrase in the preceding sentence, then that subject may be deleted and its predicate conjoined to the predicate of the preceding sentence. Deaf students whose rule for conjoining predicates was apparently similar to the rule outlined above produced such structures as The tool hurt the hunter and yelled and The hunter scared the dove and flew away (p. 104).

This phenomenon was also extensively found in the data obtained from the present investigation, and is reported as *object-subject deletion*. The present study also found evidence for what is called *object-object deletion*, where the object of the second conjunct of a conjoined sentence is deleted on identity with the object in the first sentence. Taylor also found this to be fairly common in her data, in such sentences as *The ant threw a ball on the ground and put in his room*. A further phenomenon reported for the present data as "tense sequencing" also occurred in Taylor's data. It was particularly common for deaf writers to mark tense only on the first verb of two conjoined sentences, thus producing things like *The ant went off and ride the dragonfly*.

2. Nominalization. Taylor found that her deaf subjects had great difficulty in this area--particularly in the correct use of nouns formed from verbs: gerunds (swimming) and infinitives (to swim). Confusion as to the correct use of these categories produced such errors as *The ant like to played with insects*, *The man began screamed*, and so forth. Other students seemed confused as to the correct environment for gerunds and infinitives, as in *He cannot know how to swimming* and *The hunter missed to shoot the dove*. The verb *see* also caused particular problems for deaf writers in such sentences as *The ant saw him what he was doing*.

Taylor summarizes her findings on nominalization by saying that it would appear from her data that many deaf students never fully acquire the nominalization rules of English, that they have great difficulty in acquiring some of them and that, if any are acquired, they are acquired quite late in the language development process. This is supported by the experience of investigators on the present project, who found that it was not possible to include several tests of verb nominalizations in the final test battery, because pilot testing indicated that even most of the oldest pupils were completely unable to score on them.

3. Relative Clauses. Few problems were observed in this area, again largely because Taylor's deaf subjects rarely attempted the use of relative clause structures. When they did, however, they almost invariably produced non-Standard English structures.

Three deviant structure types were prevalent in relative clauses. One was the non-use of the relative pronoun where it is obligatory in Standard English, as in sentences like *The ant held the thing look like circle*. Other examples of errors given by Taylor appear to be instances of the *copying* phenomenon found in the present study. It occurs in such sentences as *There was a little hole underground which a smart ant lived in it*. The deep structure of this is: There was a little *hole* $[_S$ a smart ant lived in the hole $]_S$ *underground*, where the bracketed sentence is embedded in the main sentence. In the Standard English rule for forming relative clauses (discussed more fully in a later chapter), the hole in the embedded sentence is replaced by which, which then moves to the front of the embedded sentence. In copying, however, which is simply inserted at the beginning of the embedded sentence and the hole, rather than being deleted, is pronominalized to it. Some deaf children also produced such structures as the hunter man, perhaps an analogy to the old man. It is held in transformational theory that such structures are "reduced relatives," i.e., that the old man is derived from a relative clause structure like the man who was old. If generalized to apply to predicate nominatives like hunter in the man who is a hunter, the hunter man can be derived.

Summary of Taylor's Findings. It can be seen from Taylor's research that deaf children's written productions, even at the age of 16 years, still deviate considerably from Standard English usage. In general, it may be said that at 16 they have achieved mastery over many aspects of the production of simple active declarative sentences. That is, they only infrequently make errors of substituting major categories incorrectly, as in The boy played a happy; rarely do they disturb the standard subject-verb-object-order of the simple sentence; and very rarely do they violate selectional restrictions, as in The rock sang a song. However, even at this advanced age, they still have many problems with the morphology of English, particularly as regards verb and noun inflections. They still also have many problems in handling the determiner and auxiliary systems of English--indeed they have more deviancies in these areas than in any others. They make relatively few mistakes in producing complex transformations, but this is only because they rarely attempt such difficult productions. It would seem from Taylor's analysis that most 16-year-old deaf children know little about the relativization and nominalization rules of English, and that when they attempt usages of such structures, they produce many deviant structures. They are, at this age, beginning to attain correct use of conjunctions rules, but, even so, still produce many conjoined sentences that are not Standard English. With this kind of information, we are moving towards pedagogically useful information. Although Taylor used the traditional terminology in speaking of examining the "errors" made by her subjects, it is clear from her analysis that these deaf children were not just making "errors" in producing English sentences, but were producing "correct" (for them) sentences from rules which, however, were not those of Standard English.

Taylor conludes that this is indeed so and this is worth quoting at some length. She says,

> the evidence for a system of rules comes in the form of repeated non-grammatical constructions occurring consistently

in the writing of a single child. Such structures suggest that a rule or rules idiosyncratic to that child's grammar are operating to produce predictable deviant structures in certain environments, deviant, that is, in terms of the target or adult grammar, not in terms of the child's grammar. One example of such idiosyncratic rules is provided by a congenitally deaf third grader whose grammar apparently included only one rule expanding the verb phrase, $VP \longrightarrow V + NP$. Thus for producing sentences of the subject-verb-object pattern, e.g., *The man saw a bird*, his grammar was adequate. However, when he attempted constructions involving verbs normally intransitive in English, his rule invariably produced such deviant structures as *The ant fell a water* or *The ant sleep a bed*, sentences in which necessary prepositions have been omitted. Moreover, in attempting to produce sentences involving intransitive verbs without prepositional phrases, this student still applied the rule $VP \longrightarrow V + NP$; however, he treated the main verb as the NP and inserted *have* as a placeholding pro-verb. The results were such anomalies as: *The ant have a swimming* for *The ant swam* and *The bird have a fly* for *The bird flew*.

Examples of such idiosyncratic rules were also found on the transformational and morphological levels. One example of an idiosyncratic transformational rule is provided by a fifth grader whose grammar apparently included a rule of the following form: Given two strings of the form $NP_1 + VP_1$ and $NP_2 + VP_2$, where $NP_1 = NP_2$, juxtapose VP_2 immediately after VP_1. This rule results in such ungrammatical predicate coordinations as *Ant walk found animals* and *Ant run get pin*. This student produced five of these compound predicates coordinated by juxtaposition, and no instance of a predicate coordinated with a conjunction, suggesting that at this particular stage in her language development her grammar included a different rule for coordinating predicates from that of the adult model.

Idiosyncratic rules at the morphological level are exemplified by a student who apparently had his own rules for inflecting verbs. This student seemed to have an exceedingly primitive system of morphological rules, as the bulk of the verbs in his corpus were of the form *is* + the uninflected verb stem, e.g., *Ant is jump on snail back*, *Ant is keep ball at home*, and *Father is go now* (pp. 64-66).

Taylor concludes,

> the deaf children's language at the four grade levels not only implies the presence of internalized rules but further indicates that their language development is a process of gradually bringing these rules into closer and closer conformity to the adult model (p. 67).

Controlled Generative Grammar Studies

Despite the valuable insights that free generative grammar studies of corpuses have provided, there are major problems with this approach. The basic problem is that neither "natural" (informally recorded) corpuses nor ones elicited by pictures or other stimuli may call forth all that a child knows and can use of his language. Several examples of this problem are available from the corpus of written productions of deaf children which have been studied during the present project. These writings were elicited in response to a series of picture sequences and not one example of a reflexive pronoun is to be found in a corpus of several hundred samples. It is thus not clear whether deaf children really cannot use reflexive pronouns or whether they simply were not elicited by this particular stimulus. Similarly, personal pronouns, although they occur in this corpus, appear in insufficient numbers to allow adequate interpretation of their pattern of development. We also noted that Taylor found very few sentence _order_ problems in her corpus, perhaps mainly because her stimulus was such that it called forth virtually no questions from her subjects--questions being an environment in which the present study found many instances of _order_ problems. Further, some constructions in the language of deaf children are so deviant that it is very difficult to disambiguate what the child "really meant" with the result that any analysis is necessarily subjective. Taylor found this to be the case in trying to decide upon the type of deviancy found in many of her categories.

For these reasons, and because careful manipulation of stimulus and response requirements can give clearer insight into the dynamics of language acquisition, production, and comprehension, many investigators are turning to "controlled" manipulation of linguistic variables. N. Chomsky (1964) early expressed doubt as to the explanatory value of "manipulation of data of texts produced under normal conditions (p.36)." and suggested that "rather devious kinds of observations of... performance, ... abilities ... and comprehension in many different kinds of circumstances will have to be obtained, so that a variety of evidence may be brought to bear on the attempt to determine what is in fact ... underlying linguistic competence at each stage of development (p. 36)." Many authors have begun to use such "devious observations" of child language; several of these have been discussed in the previous chapter.

There is now a growing body of research with deaf persons which is based on transformational generative grammar theory and which uses "controlled" presentation of stimuli. For convenience, these studies will be surveyed using the same framework as that adopted for the "free" generative grammar inspired research.

Phrase Structure Rules.

1. Omission. In her study of deaf children's understanding of the correct use of phrase structure rules, O'Neill (1973) developed a Test of Receptive Language Competence in which subjects were required to judge whether sentences generated by correct and incorrect rules were "right" or "wrong." In the omission section, her subjects (aged 9 to 17 years) made correct judgments on 75% (vs 84% for the hearing children) of the items and showed significant improvement with age. As in all her categories (the others were order, redundancy and selectional restrictions), her deaf subjects did about as well as the hearing on correctly selecting "right" sentences as "right", but they had a tendency to call "wrong" sentences "right" much more often than did the hearing children. O'Neill found that her deaf subjects were much more likely to accept incorrect sentences where function words such as determiners, prepositions and verb particles had been omitted than sentences where nouns, verbs and adjectives (content words) had been incorrectly omitted. This finding is in close agreement with that of Taylor (1969) for free written production.

2. Redundancy. This category proved to be slightly more difficult than omission for O'Neill's deaf subjects (73% correct overall, versus 85% for the hearing subjects). A similar pattern of results to that for omissions was found, with sentences containing redundant determiners, prepositions and verb particles being more difficult to judge than those containing redundant function words. It was also noted that her deaf subjects tended to accept sentences which contained a redundant verb (i.e., sentences like, The children went walked to the park).

3. Order. This category proved to be the easiest for O'Neill's subjects (90% correct, versus 86% correct for the hearing subjects). O'Neill comments "Only two grammatically incorrect sentences in the Order category were judged 'right' by these deaf subjects, which indicates that syntactic order, at least in these sentences, was not a great problem for the deaf subject (p. 92)."

O'Neill's youngest subjects were 9 years of age with a reading age of at least the second grade. Using a test in which deaf children were required to move toys to indicate the meaning of simple sentences, Power & Quigley (1973) found that many deaf children did not have a good grasp of the implications of word order for the meaning of English simple sentences. Many of the deaf subjects appeared to idiosyncratically allocate subject or object positions to toys. For example, when given a sentence and asked to act out the sentence with toys, a sentence like The car pushed the tractor the same child sometimes had the car push the tractor, and at other times had the tractor push the car. Power and Quigley also reported that non-reversibility in such sentences as The horse kicked the box, helped the deaf subjects to correctly interpret sentences from the earliest ages on. The indication was that deaf children pass through a "semantic" or "pre-syntactic" stage where interpretation of sentences is based upon momentary (and perhaps idiosyncratic) relationships between content words, with no appreciation of the role of function words or word order for sentence interpretation. This is in striking confirmation of the findings of Schmitt, whose study will be discussed in more detail later.

The Lexicon

1. Selectional Restrictions. O'Neill (1973) had a subtest dealing with this area which proved to be the most difficult subtest for both deaf and hearing subjects (82% correct for the hearing; 69% correct for the deaf). She found that her subjects accepted as correct a wide range of sentences violating selectional restriction on nouns and pronouns including the features ± animate, ± count, ± masculine, ± human, ± common, and ± concrete. For example, The desk serenaded Matilda is a violation of the restriction on animateness; Milk are good for you is a violation of the "count" restriction. Violations of preposition-noun and verb-preposition relations also occurred. There was little improvement in her deaf subjects' performance in this area with age.

2. Categorial rules. No "controlled" studies have yet been reported in this area.

3. Morphological Rules. A major study of deaf children's morphological rules has been reported by Cooper (1967). As he notes, generalizability of his results may be in doubt, as his subjects were drawn from only one school, but since replication studies with more representative samples have not been done, Cooper's results may perhaps be taken as an approximate indicator of deaf children's performance in this area. Cooper used Berko's (1958) technique of nonsense pictures ("This is a wug. Here is another wug. Now there are two _______") and nonsense words in sentences ("Mary knows how to zugg. She zuggs every day. She knows a lot about _____. Choose one of zuggy, zugged, zuggness, zugging," and so forth.) Both receptive and productive knowledge of the forms were tested.

In general, his deaf subjects performed poorly on the test. They averaged overall only 25.3 points out of a possible 48, and even the oldest children (19 years of age) averaged only 29.2

points. Some improvement in scores with age was noted. Receptive knowledge of the forms was superior to productive in all cases.

Cooper found deaf children's knowledge of inflectional morphemes (endings which when added to a base morpheme express certain grammatical relationships; e.g., verb and noun singular/plural markings; the progressive aspect marker; the superlative marker for adjectives; the possessive marker; and so on) to be superior to their knowledge of derivational markers (endings which form a new word, usually of a different grammatical class, from an existing one—the *-ly* adverb ending; *-able* adjective ending; *-ness* and *ing* noun endings; etc.). This is consistent with the difficulty deaf children have with derived nominals of various types. Cooper's data generally confirm and extend those found by Taylor (1969) in her "free" data-gathering situation.

Transformational Rules. Taylor (1969) noted deaf children's problems with three major syntactic structures—conjunction, nominalization, and relativization. No controlled studies of these structures have been reported (except in papers resulting from the present project), but studies of several other structures are available:

1. Negation. As part of a broader study Schmitt (1968) administered comprehension and production tasks involving the selection of one of four pictures to correctly match a given sentence. He found that his 8, 11, 14, and 17 year-old deaf subjects performed quite well on this task, the pattern of results indicating that most of these deaf children understood the meaning implications of the negative marker *not* in English sentences.

The one exception to this was a number of his youngest (8-year-old) subjects who failed consistently enough on this task for Schmitt to hypothesize that they were operating with what he called the *no negative rule*, "which specifies the ignoring of the marker 'not' and the treatment of negative sentences as equivalent to affirmative sentences" (p. 124). It may well be that such a response is even more typical of the performance of deaf children younger than those Schmitt tested.

2. Passive Voice. In English the meaning of a simple active sentence is provided by the subject-verb-object word order. However, the set of morphemes identifying the passive voice, the auxiliary *was*, the past participle of the verb (usually marked by the *ed* ending--*pushed*), and the agent phrase introduced by the preposition *by*, indicate that the order of action is reversed to object-verb-subject. That is, a sentence like *The boy was pushed by the girl* means that the girl pushed the boy. Passive sentences are said to be "reversible" (If interchanging the subject and object results in a grammatical, meaningful sentence, e.g. *The boy*

was pushed by the girl), or "non reversible" (*The car was washed by the boy*--compare *The boy was washed by the car*). Frequently the agent *by*-phrase is deleted because the agent of the action is unknown or obvious (*The man was killed*).

It has been demonstrated that understanding of reversed word order occurs relatively late in hearing children, and might not be fully mastered until 8 or 9 years of age (See Figures 1 and 2). Until this time some hearing children interpret passive sentences as if they were active. That is, for them *The boy was pushed by the girl* means that it is the boy who did the pushing.

It would seem that many deaf children persist in this incorrect interpretation of passive sentences until an advanced age. In the study noted previously, Schmitt (1968) also had deaf children aged from 8 to 17 years old select the one of four pictures which correctly illustrated the action of reversible passive sentences. He also had his subjects "fill-the-gap" in sentences to produce passive sentences to correctly describe pictures. He found that few of the deaf children below age 14 could pass his tests, and that even at 17 years of age, many children still could not comprehend the meaning of passive sentences or produce them correctly.

Schmitt's work was extended by Power and Quigley (1973) who used three tasks to investigate the acquisition of the passive voice by a sample of prelingually deaf children. In their *Comprehension* task children were required to move toys to show the action of the passive sentence. Three types of passive sentences were used--full reversible, full non-reversible, and agent-deleted (which can be reversible or non-reversible.) With the agent-deleted sentences a force-choice of one of two pictures which represented the action of the sentence was used instead of the toy movement task. The *Production* task was the same as Schmitt's. Children were required to select words to correctly fill the gap in a sentence for which the subject and object had been provided, in an order that was the "passive" order of a given picture. In a more detailed report Power (1971) gave the results of a third task -- a *Recognition* task. Children were presented with correct passive sentences and also with "sentences" in which the passive markers were systematically varied to provide approximations to the correct set of passive markers (*John was pushing by the boy*, *John pushed by the boy*, *John was pushed the boy*). Subjects were required to indicate if the "sentence" was "right" or "wrong." If they thought it was "wrong", they were required to rewrite it in a way that they considered correct.

Power and Quigley presented these tasks to a sample of prelingually deaf children from a state residential school--ten boys and ten girls at the ages 9-10, 11-12, 13-14, 15-16, and 17-18.

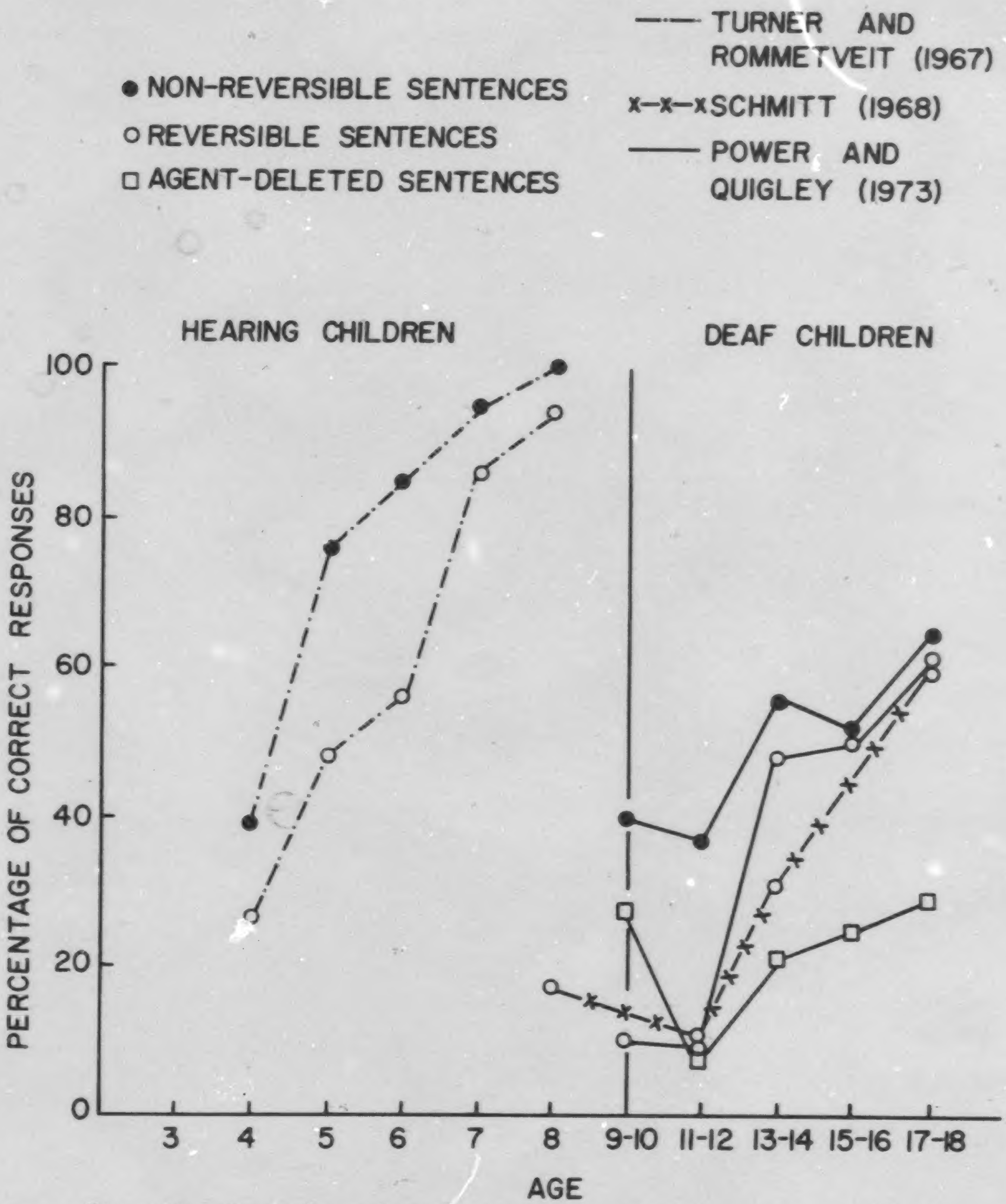


Figure 1. Comparison of deaf and hearing children on the acquisition of aspects of the comprehension of the passive voice

Note. From "Deaf children's acquisition of the passive voice" by D. J. Power and S. P. Quigley, Journal of Speech and Hearing Research, 1973 16 (1), 5-11.

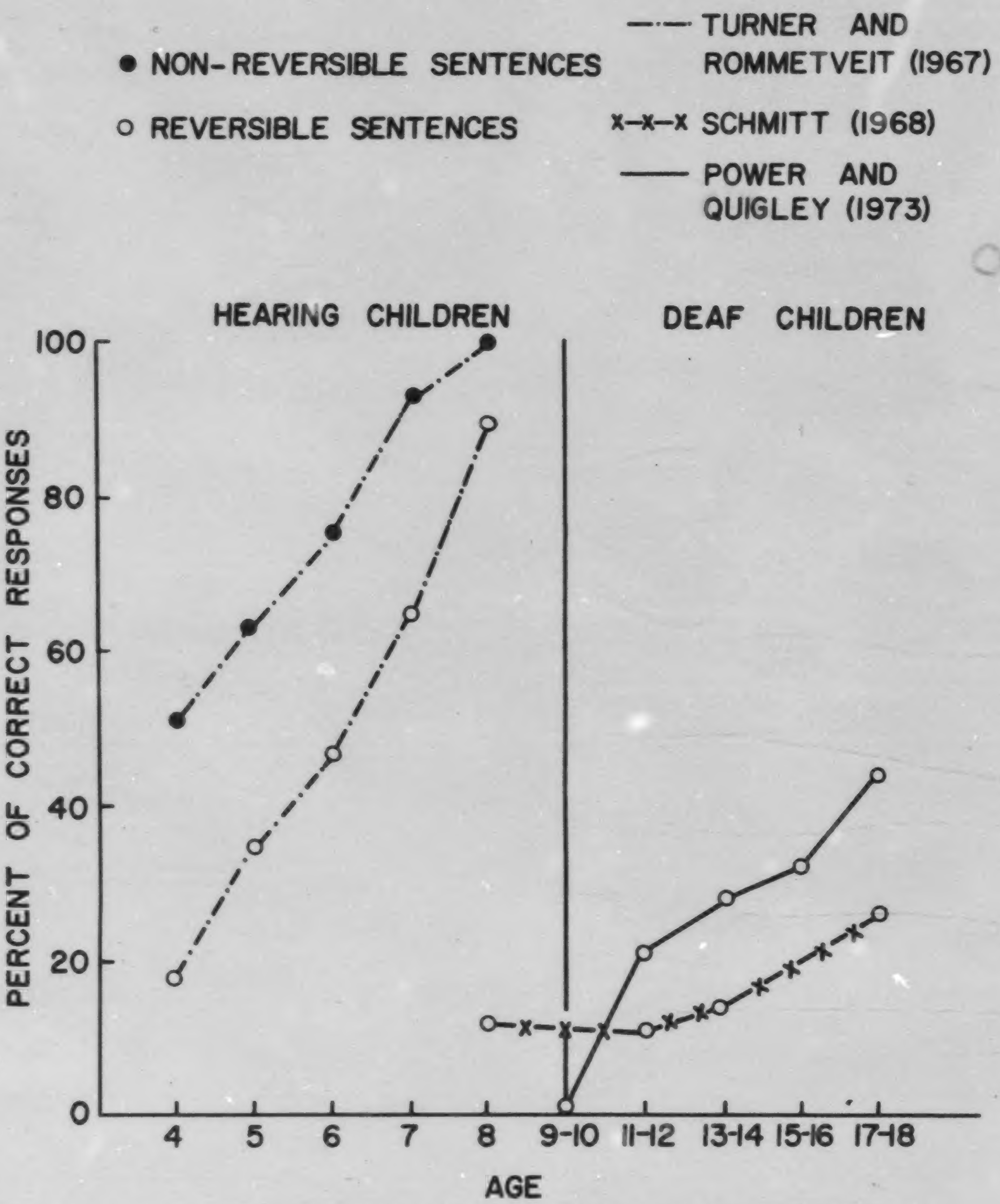


Figure 2. Comparison of deaf and hearing children on the acquisition of the production of the passive voice.

Note. From "Deaf children's acquisition of the passive voice" by D. J. Power & S. P. Quigley, Journal of Speech and Hearing Research, 1973, 16 (1), 5-11.

The results of the Comprehension task are given in Figure 1. Schmitt's results are provided for comparison, as are the results of a representative study of the acquisition of understanding of the passive voice by hearing children (Turner and Rommetveit, 1967). The findings for deaf children are similar to those for hearing children to the extent that Newman-Keuls' tests (Winer, 1962) for task mean differences, following a significant analysis of variance of the data, indicated that reversible sentences were significantly easier than non-reversible sentences, which in turn were significantly easier than agent-deleted sentences. Comparisons with the data on hearing children clearly show the great delay of deaf children in achieving mastery of the passive voice.

The results of Powers' (1971) Recognition task are given in Figure 3. These results generally support the findings of the Comprehension task, although older children do somewhat better on Recognition. Power explained the decline in acceptance of got-passive forms (e.g., Bill's tires got stolen) by the oldest children in terms of their having been taught to reject this oral colloquial form as "wrong"--as being "bad grammar."

The usefulness of the format used in the Recognition task is that it enables the elucidation of just what a child knows about a grammatical structure not only in terms of his acceptance of some right and wrong forms, but also by means of the analysis of the way he rewrites sentences he considers "wrong." Through his analysis of errors on this test, Power concluded that deaf children appear to use only by as their marker of the passive voice until an advanced age. On the Recognition task the percentage of acceptance of incorrect forms without by (was V, was Ved) declines faster than does the acceptance of incorrect forms with by (Ved by, was V by). Similarly, Power was able to show that even children who comprehend passive sentences are using only by as a marker. A significant number of children allow the tense markers to vary freely. They use was V-ing by or V-ed by to mean passive. Which one they choose seems to depend on the context. This analysis supports the findings of the Comprehension task that the by-less agent-deleted forms are not well understood by deaf children, and the findings of the Production task that many errors are due to the omission of by.

Power concluded that even at age 17-18 years a majority of deaf children have a defective rule for the processing of passive sentences, namely "passive reversal of subject-object order to process meaning of such sentences is signaled only by by; tense markers are free to vary...(p. 76)." It would seem that many deaf children are very strongly constrained to interpret all sentences in terms of the standard subject-verb-object order of the English simple sentence, even at an advanced age.

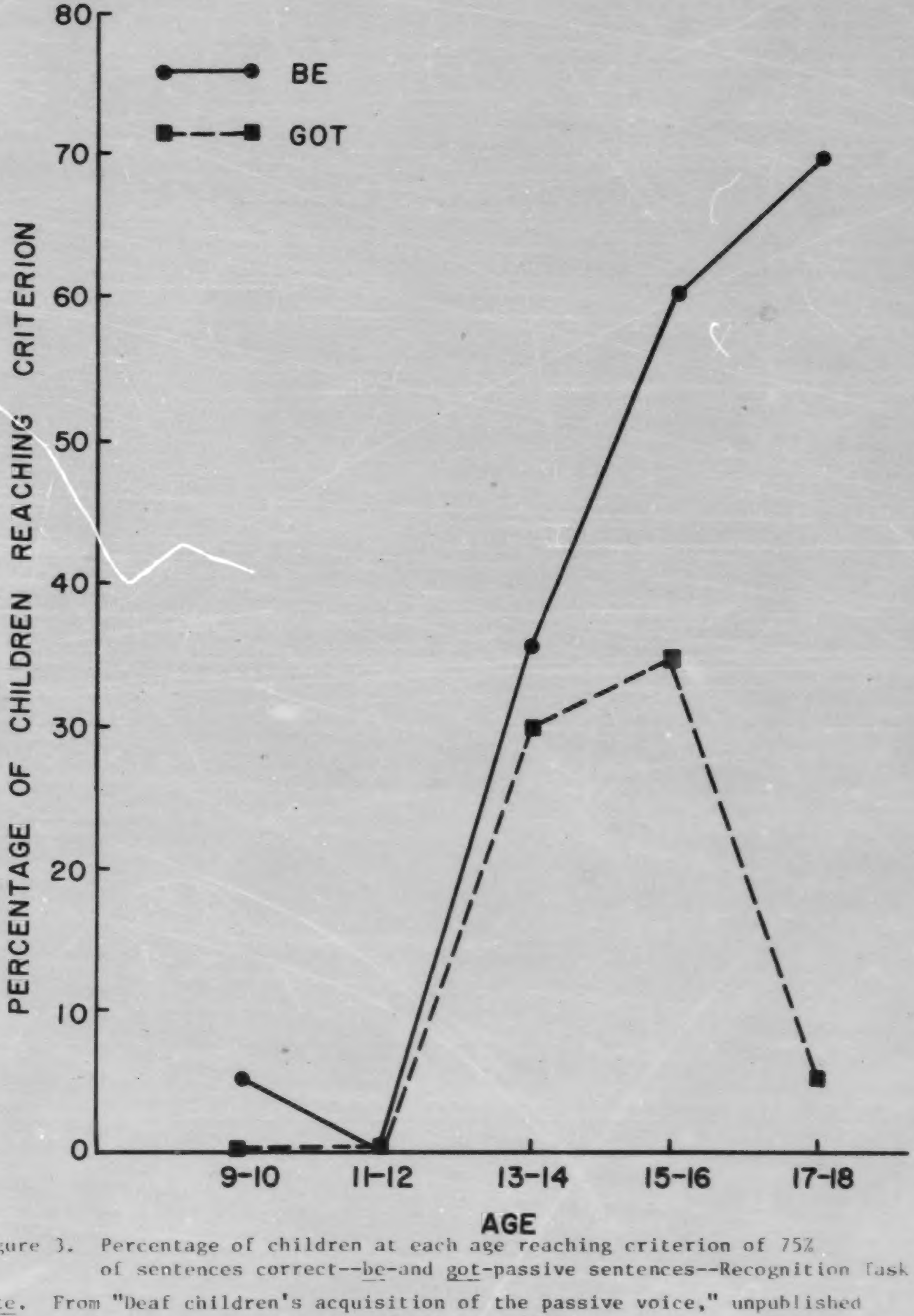


Figure 3. Percentage of children at each age reaching criterion of 75% of sentences correct--be-and got-passive sentences--Recognition Task

Note. From "Deaf children's acquisition of the passive voice," unpublished doctoral dissertation, University of Illinois, 1971; D. J. Power.

Generative grammar studies have shown that deaf students make little progress in school in acquiring control of even the "simplest" aspects of Standard English rules of grammar. They do achieve some success in mastering the structure of simple sentences, as reflected in the use of phrase structure rules and the proper placement of certain constituents in the sentence, but they still tend to overuse certain categories of sentence constituents, even at an advanced age.

Even at the age for leaving school, many deaf students have problems with correctly using English selectional restrictions. Correct use of morphological rules also proves difficult, even for many older deaf children.

It seems that many deaf students acquire good control of only the simplest English transformations (negation; conjunction using and). Complex embedding and sentence-reducing transformations of English do not often appear in their written productions, and when they do appear, deaf students make many errors in their use.

The studies most relevant to the present project are those of Quigley (1969) and Marshall and Quigley (1970). These studies as mentioned previously applied the methods developed by Hunt (1965) and O'Donnell, Griffin, and Norris (1967) to the analysis of: (a) written language samples collected by Stuckless and Marks (1966) in a cross-sectional study of a representative sample of 450 deaf students, and (b) written language samples obtained in a longitudinal five year study of 120 deaf students. The data from these studies served as a basis for the categories used in the development of the Test of Syntactic Ability (TSA) in the present study, and pointed out certain problems and "syntactic deviancies" for study both in analyzing the TSA results and in analyzing the written language samples.

CHAPTER 3

DESIGN AND PROCEDURES OF THE STUDY

As mentioned in chapter 2, the basis for the present study was the language samples gathered in the studies of Quigley (1969) and Marshall and Quigley (1970). Before developing materials for intensive testing of syntactic structure, it was necessary to determine those structures of English which appear to be most difficult for deaf students and those most worthy of further study, as well as those "deviant structures" commonly produced by large numbers of deaf students and also deserving of careful study. Therefore, the first stage of this project involved a detailed linguistic analysis of the language materials from the 1969 Quigley study; this analysis took about one year. In addition, in order to have a standard of comparison for both deaf and hearing students, a linguistic analysis of a series of reading texts commonly used with hearing children was performed, with structures listed by time and frequency of occurrence in the materials; this analysis took about a year and a half. Finally, the major part of the project involved the preparation of the Test of Syntactic Ability, a set of 22 subtests based on the results from the earlier two phases of the project, its administration to a statistically valid sample of deaf students, and an analysis of the test results. The design and procedures of each of the three stages will be discussed in detail.

Analysis of Written Language Samples

The initial stage of the research was the analysis of the written language of deaf children. Two sets of language data were available for analysis: a) written language samples obtained by Stuckless and Marks (1966) in a cross-sectional study of a representative sample of 450 deaf students, 50 at each of nine age levels from 10 to 18 years and b) written language samples obtained by Quigley (1969) in a longitudinal five-year study of 120 deaf students ranging in age from 9 to 18 years. These data were analyzed with three objectives in mind: a) to determine the structural complexity of the language used by deaf children, b) to describe certain structures which seem to be common to deaf children and which differ from structures used in Standard English, and c) to trace the pattern of development of various English syntactic structures in the written samples. The assessment of structural complexity followed the procedures established by Hunt (1965) and provided information on the increasing complexity of sentence structure and the types of structures (particularly sentence combining transformations) that are used by deaf students to produce complexity (Marshall and Quigley, 1970). The analysis of developmental patterns and deviancies from Standard English was completed for conjoined structures, the verbal auxiliary system, relative clause formation, question formation, imperatives, predicate complement constructions, pronouns, and determiners. The data from this investigation were used in two ways: a) to determine a set of categories of language problems of deaf students (i.e., rules of sentence generation which deviate from those of Standard English) for use as a basis for construction of subtests and items for the Test of Syntactic Ability, and b) to develop and validate categories of analysis for the more detailed study of the written language collected as part of the testing program.

Analysis of Reading Materials

Despite the fact that deaf children have consistently been demonstrated to perform very poorly on standardized tests of reading achievement, educators of deaf pupils have held firmly to the notion that one of the major sources of language development for the deaf child is reading. Some reading materials have been developed which are claimed to be adapted to the language capacity of deaf students, but usually teachers have had to utilize regular developmental and remedial reading materials. One such typical series is the Reading for Meaning series (4th edition), consisting of eleven texts (including three primers) for grades up to the sixth and typically used with both hearing and deaf students (McKee, Harrison, McCowen, Lehr, and Darr, 1966). This series of readers was analyzed linguistically to determine the frequency of occurrence of specific syntactic structures, for comparison with the language ability of deaf and hearing students. Various aspects of the results of this analysis will be discussed throughout this report. A detailed listing of the structures and their frequency of occurrence throughout the series of readers is also presented in the Appendix. Some technical considerations as to the best unit of statistical analysis of the findings are also presented in the appendix.

Testing Specific Syntactic Structures

As mentioned in a previous chapter, there are limitations on the information which can be obtained from analysis of written language samples.

1. Usually a picture or a picture sequence is used as a stimulus for eliciting written productions. It has been found that some types of syntactic structures do not appear in the written samples (e.g., reflexive pronouns). It is impossible to tell from the written samples alone whether this is due to deaf children's lack of ability to produce such structures, or whether it was merely that the picture stimuli did not elicit such structures.

2. Some structures (e.g., infinitival complements) do appear in the written samples, but not in sufficient numbers or variety to allow for extensive interpretation of their patterns of development.

3. Some constructions (e.g., some types of relative clauses) appear in environments such that it is difficult to disambiguate their role and clearly establish their identity and their function in the sentence.

4. Some "deviant structures" which have appeared in the written samples are of interest for linguistic theory and their study in detail becomes important (e.g., what has been called the *copying phenomenon*, which occurs in such relative clause sentences as *John saw the boy who the boy hit him*.)

For these reasons it was considered necessary to develop tests of various specific types of grammatical structures. These tests have the advantages of ensuring that as wide a range of structures as desired may be presented to the individual and of allowing for much greater control over both presentation of stimulus and elicitation of response. This provides for unambiguous consideration of individual structures so that greater insight may be obtained into the rules underlying the comprehension and production of deaf persons' sentences, and their gradual approximation to the modes of Standard English usage. Not only is it possible to study in detail structures which correspond to those of Standard English, but the tests can be developed in such a manner that specific "deviant structures" of interest might be analyzed in depth.

The Format of the Tests

Two types of test formats were used: (a) sentence completion tasks, and (b) sentence correction tasks:

Sentence completion tasks. These tasks appear in two forms: (a) as "Fill-the-Gap" exercises where the child was asked to complete a sentence correctly by inserting a word or words into a blank in a sentence, but where he was free to write any word at all (see Figure 4), and (b) as "Multiple Choice" exercises where the child was again asked to insert a word or words into a sentence, but where he was constrained in the range of choices he could make by being provided with a number of possibilities, from among which he was to choose one response as the "best" answer (see Figure 5).

A dog chased a ball. A cat chased a ball.

Make ONE sentence:

A dog ________________________________.

Figure 4. An example of an "Unconstrained Fill-the-Gap" item

Write ONE word to make a good sentence:

This coat is ______________________________.

Write ONE of:
my
you
your
yours

Figure 5. An example of a "Constrained Multiple Choice" item

This latter format was particularly useful when the range of possible answers was relatively small and could be specified accurately a priori. This technique allowed for close focusing on exactly what the child knew of this particular structure without interference from the child's understanding of similar structures. A variant of this technique was also used, where the child was not required to complete a sentence correctly, but only to select the correct answer from a range of possible answers.

Sentence correction tasks. This type of task is based upon reduction to written form of an oral technique often used by linguists using adult informants to investigate the grammar of a language. Menyuk (1969) has demonstrated the validity of these techniques in studying the oral language of very young hearing children. Perry (1968) used a similar technique in orally questioning deaf children about right and wrong sentences they had used in a written "free production" situation. In this way he was able to establish the presence of consistent rules in his deaf subjects' language performance. The format used in the TSA battery was based upon adapting these techniques to written form and to the language comprehension of deaf children.

In the sentence correction format the child was presented with either a correct or an incorrect version of the structure under consideration. Figure 6 contains a sample of the format as seen by the child. The "incorrect" (as compared with Standard English) forms were selected on the basis of common "deviant" forms previously found in the written language analysis, or, where the structure did not appear at all in the written samples, incorrect forms were constructed by systematically varying relevant aspects of the correct form.

Pilot testing of this format indicated a tendency for children who were unsure of their response to just check "RIGHT" to save themselves work. Therefore half the time when the child was presented with the structure, he was not asked to rewrite the sentence in its correct form, but only to indicate whether the sentence was "RIGHT" or "WRONG" as shown in Figure 7.

I saw the man who the man hit the dog.

Check ☑ one box. The sentence is:

RIGHT: ☐ Go to page 2.

WRONG: ☐ Change the sentence to make it RIGHT.

Write the right sentence here:____________________

____

Figure 6. Example of the format for the "Sentence Correction" task

---

I saw the man who the man hit the dog.

Check ☑ ONE box. The sentence is:

RIGHT: ☐

WRONG: ☐

Figure 7. Example of modified format for the "Sentence Correction" task

---

This "Right-Wrong-Rewrite" technique was useful where it was not desirable to constrain the types of responses allowed the child, or where it was impossible to specify a priori just what type of response would be correct. It was particularly useful for the investigation of structures which involve the whole sentence, as, for example, some aspects of the use of relative clauses.

A variant of this type of task ("Multiple Right-Wrong" format) can be found in such tests as Relativization: Embedding and Relative Pronoun Deletion, where the child was presented with a number of sentences and asked to say whether they "mean the same" as the sentences being presented to him. An example is shown in Figure 8.

John chased *the girl*. He scared *the girl*.

The sentence means the same as A.	YES	NO
John chased the girl and he scared.	☐	☐
John chased the girl who he scared.	☐	☐
John chased the girl he scared.	☐	☐

Figure 8. Example of "Multiple Right-Wrong" format

The original tests were developed to assess the following areas: a) auxiliary verbs, b) reflexivization, c) verb deletion, d) nominalization, e) relativization (processing; copying; deletion), f) conjunction (deletion rules with *and*, *or*, *but*), g) complementation (prepositions; gerunds; infinitives; verbs of perception; subject complements; extraposition), h) negation (modals; be; have), i) question formation (answer environments; question constituent ordering), and j) pronouns and determiners (personal pronouns; possessive adjectives; possessive pronouns; backward pronominalization; determiners). While this is not an exhaustive list of English structures, it does include most of the structures which are of frequent occurrence in English and are important for its comprehension and production.

Pilot Testing

These structures were pilot tested on children from ages 10 to 18 years at the Illinois School for the Deaf and in the Champaign (Illinois) Unit 4 School District. As a result of the pilot testing it was found that very few of even the oldest children tested were able to cope successfully with the *Complementation* and *Nominalization* tests. Of major importance was the fact that a number of children seemed to respond to a sentence's "rightness" or "wrongness" in terms of its ethical implications rather than its syntactic structure. They would say, for example, that a sentence like *John hit the girl* was "wrong" and rewrite it as *John was a bad boy*. Also, pilot testing revealed that the full battery of tests would take 20 hours of testing per child. As a result of these findings the tests were revised so that the final experimental form of the test battery consisted of 22 subtests which were designed to assess the deaf children's understanding of the function of 10 major aspects of English syntax.

Contents of the Present Battery

In its present form the test is known as the *Test of Syntactic Ability (Experimental Edition)*. As can be seen from

Table 1, most of the major aspects of English syntax were subdivided into several sections--making a total of 22 tests in all The number of items and the estimated time for each subtest have been included in Table 1. There were eleven uses of the "Right-Wrong-Rewrite" format; and seven of the "Multiple Choice" format. This made a total of 652 items for an estimated 5 hours and 40 minutes approximate testing time for the entire battery. Individual tests varied in length from 10 items (5 minutes testing time) to 100 items (50 minutes testing time).

Samples of written language were also collected as part of the administration of the TSA. Subjects were shown a simple picture sequence of a family preparing for and going on a picnic, and were told to write a story of at least 50 words about the pictures. Two additional picture sequences were available in the event that the original stimulus did not elicit sufficient language.

Structures Not Included in the TSA

The TSA includes a large part of the most frequent structures in English syntax--structures which carry a major part of the meaning in Standard English usage. Nevertheless, there are a number of structures which are not included in the battery. Tests were developed for some of these and were used in the pilot testing, but were not included in the final set of tests because they proved to be too difficult for even the oldest students tested. These included several aspects of *complementation* (prepositions; verbs of perception; function words; *that*-complements; subject complements; extraposition; and *tough*-movement); a test of some aspects of *nominalization* of verbs into nouns; and more extensive testing of the *copying* phenomenon, some of which is included in the relativization subtest of this battery. These tests are available for further development and a number of them might eventually be included in a future revision of the battery.

There are other areas for which tests were not developed, but which seem of some importance in the language of deaf children and which are frequent in Standard English. These include several aspects of *indirect speech*: statements, questions and commands; *adverbials*; *quantifiers*; *number agreement*; violations of normal *constitutent order*, and so forth.

Sample

Deaf Students

The sample for the research study was 450 prelingually deaf students, 25 girls and 25 boys at each yearly age level from 10 to

Table 1

Details of the Tests and Sub-tests of the Test of Syntactic Ability

Test	Item Type[a]	N Items	Time (min.)
1. Conjunction			
Conjunction	SC	24	12
Deletion	RWR	16	8
Disjunction and Alternation	SC	16	8
Sequencing	RWR	24	12
Sub-total		80	40
2. Determiners			
Determiners	RWR	32	16
3. Complementation			
Infinitives and Gerunds	RWR	32	16
4. Negation			
Be, Have	RWR	46	23
Modals	RWR	100	50
Sub-total		146	73
5. Pronominalization			
Backwards Pronominalization	MC	10	5
Personal Pronouns	MC	28	14
Possessive Adjectives	MC	14	7
Possessive Pronouns	MC	12	6
Sub-total		64	32
6. Question-Formation			
Answer Environments	MC	78	39
Auxiliaries and Modals	RWR	20	10
Wh-Questions	RWR	44	22
Sub-total		142	71
7. Reflexivization			
Reflexivization	MC	36	18

Table 1 (continued)

Test	Item Type[a]	N Items	Time (min.)
8. Relativization			
Copying	RWR	30	15
Embedding and Relative Pronoun Deletion	MRW	18	18
Processing	MRW	10	10
Relative Pronoun Referents	MC	18	9
Sub-total		76	52
9. Verb Deletion			
Verb Deletion	RWR	16	8
10. Verbal Auxiliaries			
Verbal Auxiliaries	RWR	28	14
GRAND TOTAL		652	340

[a] SC = Sentence Completion Format
RWR = Right-Wrong-Rewrite Format
MC = Multiple Choice Format
MRW = Multiple Right-Wrong Format

18 years. To select this sample all educational programs for deaf students in the United States with 100 or more students (Directory of Services for the Deaf in the United States, American Annals of the Deaf, May 1970), were stratified on the basis of the nine geographical regions officially recognized for demographic purposes by the United States Bureau of the Census. The programs were then further stratified according to whether they were mainly day or residential in pupil populations. One day and one residential program were then selected randomly from each of the nine geographical regions. Only six day programs could be included because three regions (New England, East South Central, Mountain) did not have day programs with 100 or more deaf students. A tenth residential school was also added to provide a group of students from an oral residential program.

From these 16 programs, 25 boys and 25 girls were randomly selected at each of the nine age levels. To be included on the lists from which the sample was drawn, subjects had to meet the following criteria:

(1) Sensori-neural hearing impairment of not less than an average of 90 db (ISO) in the better ear at 500, 1000 and 2000 Hz,

(2) Born deaf or deafened before the age of two years,

(3) An IQ of at least 80 on the performance scale of the WISC or WAIS or some comparable test,

(4) In the judgment of school personnel, no apparent disability other than hearing impairment (except for corrected visual defects).

The number of subjects chosen within each program was proportional to the total number of students in the region and to their distribution in day and residential programs (Table 2). Table 3 shows the numbers actually selected from each program. Table 4 shows selected characteristics of the children finally included in the sample. The data in Table 4 indicate that the sampling procedures were successful in providing a group of subjects who may be considered to be representative of non-multiply disabled severely deaf students in school programs in the United States.

Hearing Students

A group of children with normal hearing was also tested to serve as a general comparison group and to aid in the interpretation of test results. This group consisted of 60 children, 10 boys and 10 girls at each yearly age from 8 to 10 years from the third, fourth, and fifth grades of a middle class public school.

Table 2

Schools and Their Student Populations

Region	Residential Number	Residential Population	Residential Percent	Day Number	Day Population	Day Percent
New England	5	1,102	5.23	--	---	--
Mid-Atlantic	9	2,524	11.98	4	805	3.82
E. N. Central	7	1,663	7.89	11	2,165	10.27
W. N. Central	6	1,619	7.68	1	175	.83
S. Atlantic	10	3,356	15.92	3	532	2.53
E. S. Central	4	1,461	6.93	1	110	.53
W. S. Central	5	1,717	8.15	3	616	2.93
Mountain	4	853	4.05	--	---	--
Pacific	4	1,583	7.51	5	802	3.81
Total	54	15,878	75.34	28	5,205	24.72

Total population	Total schools
21,083	82

Note: School programs with more than 100 students only

Table 3

Numbers of Subjects Chosen from Each Region for Each Age Sub-Sample

Region	Residential school			Day school		
	Boys	Girls	Total	Boys	Girls	Total
New England	1	2	3	-	-	-
Mid-Atlantic	3	3	6	1	1	2
E. N. Central	2	2	4	3	2	5
W. N. Central	2	2	4	-	1	1
S. Atlantic	4	4	8	-	1	1
E. S. Central	2	1	3	-	-	-
W. S. Central	2	2	4	1	-	1
Mountain	1	1	2	-	-	-
Pacific	2	2	4	1	1	2
	19	19	38	6	6	12

Grand total	Total boys	Total girls
50	25	25

Table 4

Characteristics of the Research Sample

	Hearing threshold level (dB)[a]		Age at onset of hearing impairment[b]			IQ	
Age	Mean	SD	1 yrs.	2	3	Mean	SD
10	97.0	4.3	84	92	98	104.3	15.4
11	93.7	8.7	78	92	100	103.6	14.5
12	95.0	5.6	87	95	100	99.6	12.7
13	94.0	8.1	85	91	95	106.2	15.4
14	94.9	7.3	77	86	91	105.8	20.7
15	94.4	7.0	92	94	98	103.8	17.7
16	94.6	7.1	80	95	97	107.2	13.9
17	94.4	7.3	76	86	94	105.1	15.0
18	94.9	9.0	78	82	88	105.9	19.9
Overall	94.8	7.2	82	90	96	104.6	16.1

[a] Better ear average at 500, 1000 and 2000 Hz (ISO).

[b] Cumulative percentage. Difference between this figure and 100% were children classified as Unknown Age of Onset.

Testing Procedures

Training of Testers

Each cooperating program was asked to nominate a faculty member or other suitable qualified and experienced person to conduct the testing for its section of the sample. Every program was able to do so, and all nominated testers attended a two-day program meeting with the project staff in September, 1971. During this meeting project staff explained the rationale and construction of the TSA, the purpose of the study, and the kind of outcomes hoped for from the analysis of test results. Much time was spent in training the testers in the details of test administration, the use of the practice-item transparencies, and so forth. A member of the project staff who had participated in the pilot testing gave demonstrations of test administration with groups of deaf children. Time for study of the tests, questions and discussions was provided until project staff were satisfied that testers were thoroughly conversant with all aspects of test administration. Each tester was supplied with a tester's manual, overhead transparencies for practice and explanatory introductory items, an article on the construction and rationale of the tests, and a complete set of the TSA subtests for personal reference.

Communication with testers later indicated that few major problems were encountered in administration of the tests. Much valuable feedback was obtained, however, from testers' comments, both in informal communications and on the "Record of Observations" which each tester filled out for each testing session. It is intended to incorporate many of these suggestions in the planned revision of the TSA for eventual classroom diagnostic use.

Administration of Tests

Scheduling of test sessions, which were each usually less than one hour in length, was left to the discretion of the cooperating schools, although the order of presentation of subtests within sessions and across sessions had been specified in advance by project staff. The collection of the written compositions preceded the administration of the subtests of the TSA. Administration of the complete TSA took between four and eight hours, depending upon the age of the subjects. Hence testing in the programs was spread over a period of approximately two months, (November and December of 1971), although a couple of programs required about one month longer. Although the sample of deaf pupils consisted of 450 children, absenteeism in schools meant that not all 450 were present for every session; however, very few losses were in fact occasioned this way, and the number of subjects of each sex at each age level was satisfactorily high.

Data Analysis

To facilitate analysis the data were grouped into six major linguistic structures: relative clauses, question formation, conjunction, negation, pronominalization, and the verb system. Each of these structural areas included several of the subtests of the TSA and an analysis of that structure in the written language samples. Analysis of each of the six structural units took place in two stages: linguistic analysis and statistical analysis.

Linguistic Analysis

Linguistic analysis of a particular structure included an analysis of test responses and also analysis of the separate written compositions produced by the subjects. Analysis of the sentences in the written compositions focused on those sentences which were relevant to a specific structure. The linguists analyzed the sentence structure according to its grammaticality, type of deviance (if any), and function. The number of occurrences of standard and non-standard syntactic patterns was recorded, and non-standard patterns were categorized according to the type of information each provided.

Statistical Analysis

The major statistical analysis concentrated on the effects of age on the acquisition of each structure and the difference in patterns of acquisition which represented standard or non-standard acquisition of various aspects within each of the major structures. A preliminary step in the analysis of the data from the TSA was a detailed analysis of the test items using the Mermac Test and Questionnaire Analysis Programs (Costa, 1971), available at the University of Illinois. This package of computer programs provided information on the "goodness" of each item (ability of the item to discriminate among subjects) as well as information on the reliability (Kuder-Richardson 20) of each subtest of the TSA and the reliabilities of each of the item subgroupings within each subtest.

The principal statistical technique employed for analysis of the test data for each major structure was the analysis of variance in both its multivariate and univariate forms. Multivariate analysis of variance, which has multiple independent and dependent variables, considers differences among the subjects on all dependent variables simultaneously, thus eliminating problems which arise in univariate analysis of variance due to correlations among the dependent variables. For this reason it was used to determine the significance of the age differences and age trends for all item subgroupings within a particular subtest, and for all subtests within a particular structure. Univariate analysis of variance was used to determine interaction effects within a structure where there were multiple independent variables but only one dependent variable.

The statistical analysis of the written compositions served to supplement the findings of the TSA. The principal analysis included frequency counts by age for all of the categories of scoring established by the linguistic analysis. The written composition frequency counts provided information on the number of times a student attempted to use a structure, the number of correct or incorrect uses, and the number and variety of "errors" that occurred.

CHAPTER 4

INTRODUCTION TO RESULTS CHAPTERS

Each of the following seven chapters concerns itself with one of the major structural groupings into which the TSA subtests were grouped for analysis: relativization, conjunction, complementation, pronominalization, question formation, negation, and use of verbs. In addition to the results of the data analysis, each chapter also includes a linguistic summary of the structure, a review of the related literature, and a discussion of the findings. The interrelationships among the structures, and between the structures and the demographic data, are presented in

Demographic Information

Each school which participated in the study was asked to provide demographic information about its students who served as subjects of the research. In addition to the IQ, hearing threshold level, and age at onset of hearing impairment mentioned previously, this information included: number of years in school after age six, number of years in school before age six, total number of years in school, parental hearing impairment, sibling hearing impairment, and hearing aid use. These data are reported here to provide a detailed picture of the subjects of the investigation.

Of the 450 deaf students who participated in the research, demographic information was available for 437 students (97%). For each of these 437 students, data were available on most variables. For 13 students (3%) neither the schools participating in the study nor the Directory of Services for the Deaf in the United States (American Annals of the Deaf, May, 1970) had any of the demographic data requested except sex. Of the 437 students for whom demographic information was available, 213 were male (48.7%) and 224 were female (51.3%). Although the majority of the subjects came from families with no other hearing impaired members, about 6% had two deaf parents and another 1% had one parent who was deaf, nearly 17% had one deaf sibling, while 6% had two deaf siblings and 3% had more than two. A breakdown of the demographic variables by sex is given in Tables 5 and 6. As the tables show, there were no significant differences between the male and female students on the demographic variables.

An examination of these same demographic variables by age was also undertaken (see Tables 7 and 8). One way analysis of variance revealed that there were no differences among the nine age groups on the following variables: IQ, hearing threshold level (HTL), or years in school before age 6. Pearson's χ^2 test for differences in distribution indicated that the

Table 5

Means and Standard Deviations of IQ, Hearing Threshold Level, and Years in School by Sex

	Males			Females		
Demographic Variable	N	$\overline{X}$	SD	N	$\overline{X}$	SD
IQ	193	105.68	16.29	190	103.46	16.52
Hearing threshold level	184	94.78	7.36	197	94.78	7.25
Total years in school	209	8.14	3.04	220	8.18	2.94
Years in school before age 6	209	1.41	1.30	220	1.41	1.29
Years in school after age 6	210	6.72	2.68	220	6.78	2.82

Table 6

Frequencies of Occurrence (by sex) for Age at Onset of Hearing Impairment, Parental Hearing Impairment, Sibling Hearing Impairment, and Hearing Aid Use

	Sex	N	% of Sample	N	% of Sample	N	% of Sample	N	% of Sample	N	% of Sample
		< 12 months		12-23 months		> 23 months		Unknown			
Age at onset of hearing impairment	M	176	82.63	21	9.86	10	4.69	6	2.82		
	F	182	81.25	16	7.14	14	6.25	12	5.36		
		Both hearing		Both deaf		One parent deaf		Unknown			
Parental hearing impairment	M	189	88.73	10	4.69	3	1.41	11	5.16		
	F	189	84.38	18	8.04	4	1.78	12	5.80		
		No deaf sibs		1 deaf sib		2 deaf sibs		More than 2		Unknown	
Sibling hearing impairment	M	155	72.77	39	18.31	10	4.69	6	2.81	3	1.41
	F	159	70.98	35	15.63	17	7.59	7	3.11	6	2.68
		No		Yes		Unknown					
Hearing aid use	M	86	40.38	119	55.87	8	3.76				
	F	74	33.04	139	62.05	11	4.91				

Table 7

Means and Standard Deviations of IQ, Hearing Threshold Level, and Years in School for Deaf Students at Each Age Level

	IQ			HTL			Total yrs. in school			Yrs. school before 6			Yrs. in school after 6		
Age	N	$\bar{X}$	SD	N	$\bar{X}$	SD	N	$\bar{X}$	SD	N	$\bar{X}$	SD	N	$\bar{X}$	SD
10	40	104.33	15.39	45	96.98	4.34	50	4.46	1.54	50	1.56	1.25	50	2.90	.73
11	42	103.57	14.48	45	93.67	8.70	50	5.56	1.28	50	1.58	1.31	51	3.96	.74
12	45	99.56	12.73	45	95.00	5.59	53	6.38	1.46	53	1.42	1.12	53	4.96	.73
13	38	106.16	15.43	41	93.98	8.07	46	7.15	1.43	46	1.26	1.15	46	5.84	.78
14	38	105.82	20.70	37	94.92	7.25	42	8.07	2.01	42	1.41	1.33	42	6.68	1.55
15	40	103.83	17.71	43	94.49	6.99	47	8.94	1.96	47	1.43	1.33	47	7.51	1.29
16	43	107.16	13.87	41	94.56	7.12	45	10.11	1.72	45	1.31	1.24	45	8.84	1.10
17	49	105.10	14.96	44	94.43	7.31	49	11.14	1.64	49	1.33	1.41	49	9.82	.63
18	48	105.94	19.95	40	94.93	8.96	47	12.21	1.89	47	1.34	1.45	47	10.87	1.16
$\bar{X}$	43	104.61	16.44	42	94.78	7.31	48	8.16	2.99	48	1.41	1.30	48	6.75	2.75

Total years in school: $F\ (8,420) = 114.30,\ p < .001$
Years in school after age 6: $F\ (8,421) = 353.91,\ p < .001$

Table 8

Frequencies of Occurrence (by age) for Age at Onset of Hearing Impairment, Parental Hearing Impairment, Sibling Hearing Impairment, and Hearing Aid Use

	10		11		12		13		14		15		16		17		18	
	N	% of[a] sample	N	% of sample	N	% of sample	N	% of sample	N	% of sample	N	% of sample	N	% of sample	N	% of sample	N	% of sample
Age at onset																		
< 12 mos	42	84	40	78	46	87	40	85	33	77	44	92	37	81	38	76	38	78
12-23 mos	4	8	7	14	4	7	3	7	4	9	1	2	7	15	5	10	2	4
> 23 mos	3	6	4	8	3	6	2	4	2	5	2	4	1	2	4	8	3	6
Unknown	1	2	0	0	0	0	2	4	4	9	1	2	1	2	3	6	6	12
Parental hearing impairment																		
Both hearing	45	90	45	88	44	83	39	83	39	91	43	90	40	87	41	82	42	86
Both deaf	3	6	3	6	3	6	4	8	1	2	1	2	5	11	4	8	4	8
One deaf	1	2	1	2	1	2	1	2	0	0	1	2	0	0	2	4	0	0
Unknown	1	2	2	4	5	9	3	7	3	7	3	6	1	2	3	6	3	6
Sibling hearing impairment																		
No deaf sibs	34	68	32	63	44	83	34	73	31	72	32	67	33	72	36	72	38	76
One deaf sib	11	22	12	23	5	9	10	21	9	22	7	15	9	20	5	10	6	12
Two deaf sibs	4	8	5	10	3	6	0	0	1	2	4	8	2	4	6	12	2	4
More than two	1	2	1	2	1	2	2	4	1	2	3	6	1	2	2	4	1	2
Unknown	0	0	1	2	0	0	1	2	1	2	2	4	1	2	1	2	2	4
Hearing aid use																		
Yes	15	30	19	37	19	36	12	26	15	35	19	40	19	41	21	42	21	43
No	32	64	31	61	33	62	34	72	26	60	28	58	26	57	26	52	22	45
Unknown	3	6	1	2	1	2	1	2	2	5	1	2	1	2	3	6	6	12

[a] The percentages in this table have been rounded to the nearest whole number so that all information would fit on one page.

frequencies of occurrence for age at onset of hearing impairment, parental hearing impairment, sibling hearing impairment, and hearing aid use were not significantly different from one age to another.

In summary, these findings indicate that the student sample used in this study was a homogeneous group in terms of those demographic variables which were included for study. Thus, it is likely that language differences which are reported in the following chapters are the result of experience (educational, social, etc.) and not a result of differences in sex, intelligence, hearing threshold level, age at onset of hearing impairment, preschool program, family deafness, or hearing aid use.

Achievement Data

Information on the students' performance on standardized achievement tests was also collected from the schools when available. The three achievement batteries used most frequently by the schools participating in the study were: the Stanford Achievement Test, the California Achievement Test, and the Metropolitan Achievement Test. An examination of student performance for each of the test batteries revealed that across all age groups spelling and arithmetic skills were at a higher level of achievement than language and reading skills. Table 9 gives the means and standard deviations for each of the achievement test subtests. These data are presented as a matter of general interest but caution must be exercised in interpreting them, particularly in comparing one test battery to another, since different schools used different batteries. For those achievement subtests dealing with language and reading skills and for which there were a sufficient number of subjects available at each age, there is a breakdown in Table 10.

For those students who took the Stanford Achievement Test (SAT), there was a steady increase in scores from age 10 to age 18 for word meaning, paragraph meaning, spelling, and language. Word meaning and paragraph meaning scores were similar, ranging from 1.96 to 4.32 and from 1.87 to 4.65, respectively. Language and spelling scores indicated a more rapid increase with age; language scores increased from 2.20 to 5.95 at age 18, while spelling scores were by far the best with a 7.54 grade level at age 18.

The California Achievement Test (CAT) scores and the Metropolitan Achievement Test (MAT) scores similarly demonstrated a general increase with age, although with a few more ups and downs than the SAT. It is interesting to note that in every one of the six subtests of the CAT and MAT listed in Table 10, the 18-year-olds performed more poorly than did the 17-year-olds--a phenomenon observed in the study also, which will be discussed in later chapters.

Table 9

Number of Subjects, Mean and Standard Deviation for Each of the Subtests in the Achievement Test Batteries, Given in Grade Equivalents

	N	$\bar{X}$	SD
Stanford Achievement Test			
Word Meaning	178	2.92	1.07
Paragraph Meaning	188	3.13	1.34
Vocabulary	42	1.37	.20
Science and Social Studies Concepts	64	2.22	.75
Spelling	101	5.55	2.59
Word Study Skills	39	2.42	.87
Language	137	4.38	1.75
Arithmetic	133	5.67	2.11
Arithmetic Concepts	179	3.72	1.98
Arithmetic Applications	57	5.68	1.73
Social Studies	65	5.37	1.33
Science	61	4.95	1.67
California Achievement Test			
Vocabulary	73	4.49	3.48
Reading Comprehension	72	4.51	2.01
Arithmetic Computation or Reasoning	72	4.48	1.99
Arithmetic Concepts and Problems/Fundamentals	72	5.14	2.04
Language Usage and Structure	52	5.83	2.37
Spelling	77	5.08	2.26
Battery Average	115	4.86	1.98
Metropolitan Achievement Test			
Word Knowledge	69	3.51	1.33
Reading	58	3.70	1.27
Spelling	49	5.32	2.02
Word Analysis	3	2.67	1.25
Language	46	5.15	2.06
Computation	52	5.99	1.88
Concepts	52	4.84	1.98
Problem Solving	52	4.73	1.96

Table 10

Means and Number of Subjects at Each Age for Selected Language and Reading Achievement Tests

Age	N	$\bar{X}$	N	$\bar{X}$	N	$\bar{X}$	N	$\bar{X}$
			Stanford Achievement Test					
	Word Meaning		Paragraph Meaning		Spelling		Language	
10	16	1.96	16	1.87	7	1.97	4	2.20
11	21	2.18	20	2.20	6	3.09	9	3.27
12	20	2.38	21	2.36	6	3.38	13	3.29
13	21	2.54	21	2.75	7	3.73	13	3.70
14	19	2.59	19	2.55	7	3.99	15	3.73
15	23	2.92	24	3.04	12	5.51	17	4.12
16	20	3.79	20	3.95	16	6.16	20	4.98
17	19	3.52	24	4.15	19	7.02	24	4.77
18	19	4.32	23	4.65	21	7.54	22	5.95
			California Achievement Test					
	Reading average		Language average					
10	12	2.69	12	3.28				
11	13	2.95	13	3.64				
12	14	3.10	14	4.01				
13	12	3.14	12	4.14				
14	12	4.30	12	5.86				
15	12	3.87	12	5.26				
16	13	5.18	13	7.19				
17	14	5.92	14	7.54				
18	14	5.57	14	7.17				
			Metropolitan Achievement Test					
	Word Knowledge		Reading		Spelling		Language	
10	5	2.50	1	2.00	2	3.80	2	3.80
11	7	2.93	4	2.63	6	4.48	3	3.30
12	10	2.67	9	2.99	8	4.34	7	4.10
13	10	3.42	9	3.72	7	5.01	7	5.11
14	6	3.42	6	3.57	3	4.38	4	4.75
15	9	4.24	7	3.80	7	5.56	7	5.93
16	7	3.38	7	4.30	5	5.12	5	5.14
17	7	4.31	7	4.51	5	8.02	5	6.90
18	8	4.06	8	3.99	6	6.20	6	5.72

The California Achievement Test scores were somewhat higher than those of the SAT, ranging from 2.69 to 5.57 over the age range for reading, and from 3.28 to 7.17 for the language subtest. For the Metropolitan Achievement Tests, however, scores were more compressed--higher at the younger ages and lower at the older--than the SAT. The ranges were: 2.50 to 4.07 for word knowledge, 2.00 to 3.99 for reading, 3.80 to 6.20 for spelling, and 3.80 to 5.72 for language.

Looking at the results from the three tests overall, it is clear that student achievement increases with increasing age. However, improvement was very slow and all of the achievement test results are well below the expected grade level. Even on the spelling subtests the students reached only the sixth or seventh grade level by age 18 on the SAT and MAT, while attaining only the sixth-seventh grade level in language skills and only about the fourth grade level in reading skills. And even the higher scores of the CAT showed only a seventh grade attainment in language and fifth-sixth grade in reading.

Ordering of Results Chapters

Many of the most interesting features of deaf children's language are exhibited in the so-called "recursive" structures: those which might be simply described as consisting of two or more simple sentences joined into one. These, therefore, will be discussed first. In English, the three recursive processes are relativization (The boy who hit Mary is my brother), conjunction (Bill and Tom are seniors), and complementation (John demanded that Mary leave early). The three are treated in order of interest in chapters 5, 6, and 7. Chapter 5 deals with relativization, and chapter 6 deals with conjunction, a process which is closely related to relativization in the types of "deviancies" to which it leads. Complementation is treated in chapter 7.

Of the non-recursive processes, pronominalization is discussed first, in chapter 8; its analysis overlaps that of relativization, since relativization involves pronouns as well (who, which, that). Question formation and negation involve similar transformational rules in their description, and are treated in sequence in chapters 9 and 10. Finally, chapter 11 deals with the analysis of verb processes.

CHAPTER 5

RELATIVIZATION

Relativization is one of three major recursive processes of English, the other two being conjunction and complementation. Very briefly, to form a relativized structure, one sentence must be reduced and embedded within another by a series of transformational rules. The two original sentences must contain noun phrases with common reference; for example, The man is my friend. The man lives down the street. The two sentences contain a coreferent noun phrase, the man, and can be combined by transformations into The man who is my friend lives down the street.

There are four possible types of relative pronoun reference: identity between the subject of the main sentence and the subject of the embedded sentence (subject-subject environment), between the object of the main sentence and the subject of the embedded sentence (object-subject environment), between the subject of the main sentence and the object of the embedded sentence (subject-object environment), or between the objects of the main and embedded sentences (object-object environment). The embedded sentence must meet one of these four conditions before it can be relativized.

Relative clauses can also be classified according to their placement with respect to the main sentence. The embedded sentence can be final (I saw the boy who went home) or medial (The boy who went home is my friend). Relative clauses can also be grouped according to the function of the relative pronoun. For example, in The boy who went home is my friend, who serves as the subject of the relative clause. In The boy who(m) I saw is John, on the other hand, who(m) serves as the object of saw. A relative clause, therefore, can be one of four types: subject-final, subject-medial, object-final, or object-medial.

Results

The results reported here were derived from the three TSA subtests developed to assess deaf students' knowledge of relativization: Processing, Embedding, and Copying. The Processing subtest assessed students' comprehension of sentences containing relative clauses. Subjects were presented with a complex sentence containing a relative clause followed by a set of simple sentences containing the same vocabulary items. They were then required to check yes or no depending on whether or not each simple sentence expressed the intent of the stimulus sentence. An example follows:

The woman loved the man she saw.

The woman loved the man. yes____ no____
The man saw the woman. yes____ no____
The woman saw the man. yes____ no____

The Embedding subtest examined the students' comprehension of relativized sentences as compared to their non-relativized counterparts. The children were given two exemplar sentences and asked whether a single-sentence relativized version of the sentences "means the same" as the two examples. A conjoined version of the example sentences was also given. For example:

The dog chased the girl. The girl had on a red dress.

The sentence means the same as A.

The dog chased the girl had on a red dress. yes____ no____
The dog chased the girl who had on a red dress. yes____ no____
The dog chased the girl and had on a red dress. yes____ no____

Finally, the Copying subtest was designed to investigate certain "deviant" syntactic patterns found in the language of deaf individuals. Subjects were asked to judge whether stimulus sentences were "grammatical" or not ("right" or "wrong").

Multivariate analysis of variance (Bock, 1966) was used to determine the significance levels of age differences for each of the relativization subtests. As Table 11 indicates, all three subtests showed significant linear increases in performance of the deaf students with increasing age.

Table 11

Reliabilities and Significance Levels for the Three Relativization Subtests

	# items		Age			Linear trend		
Test		Reliability	F	df	p<	F	df	p<
Processing	10	.76	13.175	8,419	.001	101.61	1,419	.001
Embedding	18	.80	5.906	8,419	.001	38.01	1,419	.001
Copying	30	.79	13.583	8,419	.001	97.25	1,419	.001

It will be noticed in the results section of this and the following chapters that the performance of the 9-year-old hearing students and 18-year-old deaf students was frequently lower than would be expected from the performance of the subjects at other ages. Since all of the hearing subjects came from the same public school, this lowered performance of the 9-year-old hearing students can most probably be considered a sampling artifact. It is also possible to speculate that the lowered performance of the 18-year-old deaf students may have been the result of the better students having already left the school system by this age.

Processing

Figure 9 shows the percent of correct responses by age for the deaf and hearing students on the Processing subtest. As expected, the hearing students performed at a higher level than the deaf students, even though the hearing students were much younger in age. The oldest hearing students (10 years) attained 83% correct responses, while the oldest deaf students (18 years) attained only 76% correct.

In order to examine the effects of relative pronoun type (subject or object) and relative clause position (medial or final), the subtest items were grouped for analysis of variance into: subject-medial (the girl who hit the boy went home; 8 items, $r = .342$); subject-final (the girl saw the boy who kicked the cat; 7 items, $r = .704$); object-medial (The man who(m) the woman saw bought a hat; 8 items, $r = .751$); and object-final (The woman loved the man who(m) she saw; 13 items, $r = .787$). As can be seen in Figure 10, both deaf and hearing subjects had more difficulty understanding relative clauses when the relative pronoun was in object position than when it was in subject position, $F\ (1,419) = 34.38$, $p < .001$. Figure 11 shows that much greater difficulty was experienced by both groups of subjects when relative clauses were in medial position in a sentence than when they were in final position, F, $(1,419) = 705.34$, $p < .001$. The interaction of subject-object and medial-final was also significant, $F\ (1,419) = 89.22$, $p < .001$. Which type of relative pronoun was more difficult, then, actually depended on the position of the embedded clause in the sentence. Object clauses in final position ($\bar{X} = 83\%$) were easiest, followed by subject clauses in final position ($\bar{X} = 79\%$), then subject clauses in medial position ($\bar{X} = 55\%$), with object clauses in medial position ($\bar{X} = 41\%$) being the most difficult.

Figure 12 shows the percent of incorrect responses by age for deaf and hearing subjects on two items with medially embedded relative clauses, which might explain at least part of the difficulty that medially embedded clauses present for both deaf and hearing students. The two items were the following:

1. The girl who hit the boy went home.

   a. The boy went home. yes____ no____
   b. The girl went home. yes____ no____

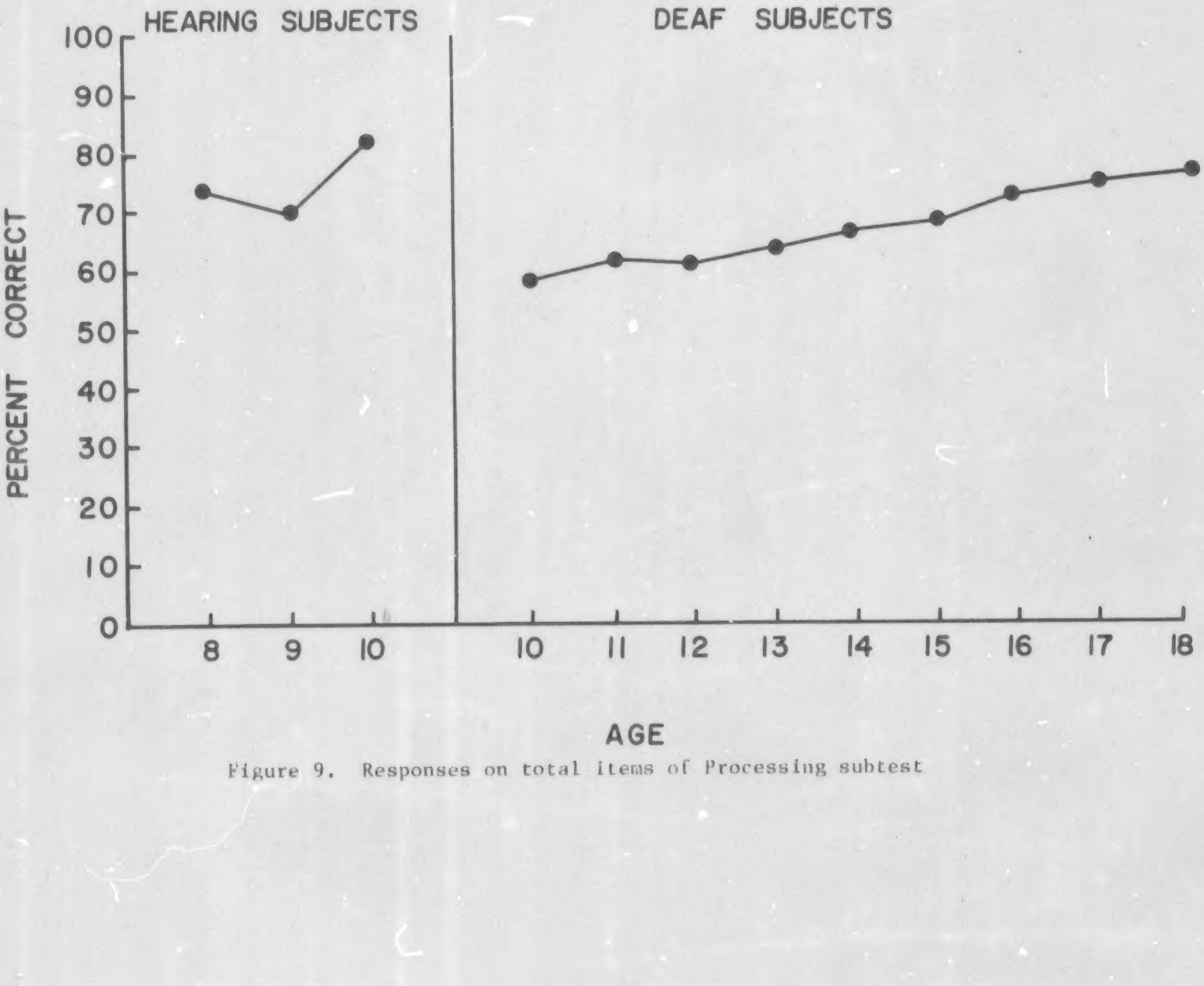


Figure 9. Responses on total items of Processing subtest

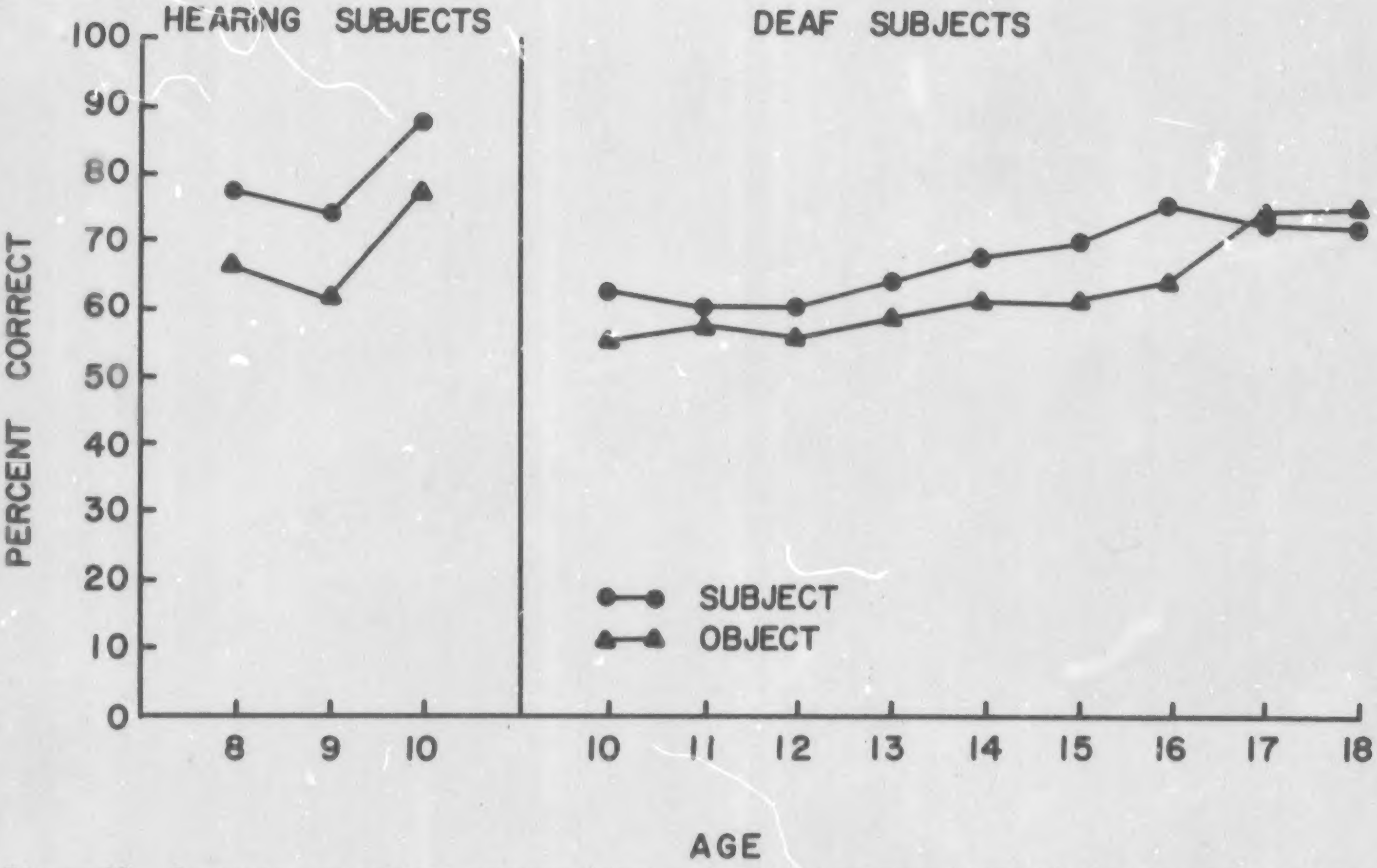


Figure 10. Responses on subject pronoun items and object pronoun items of the Processing subtest

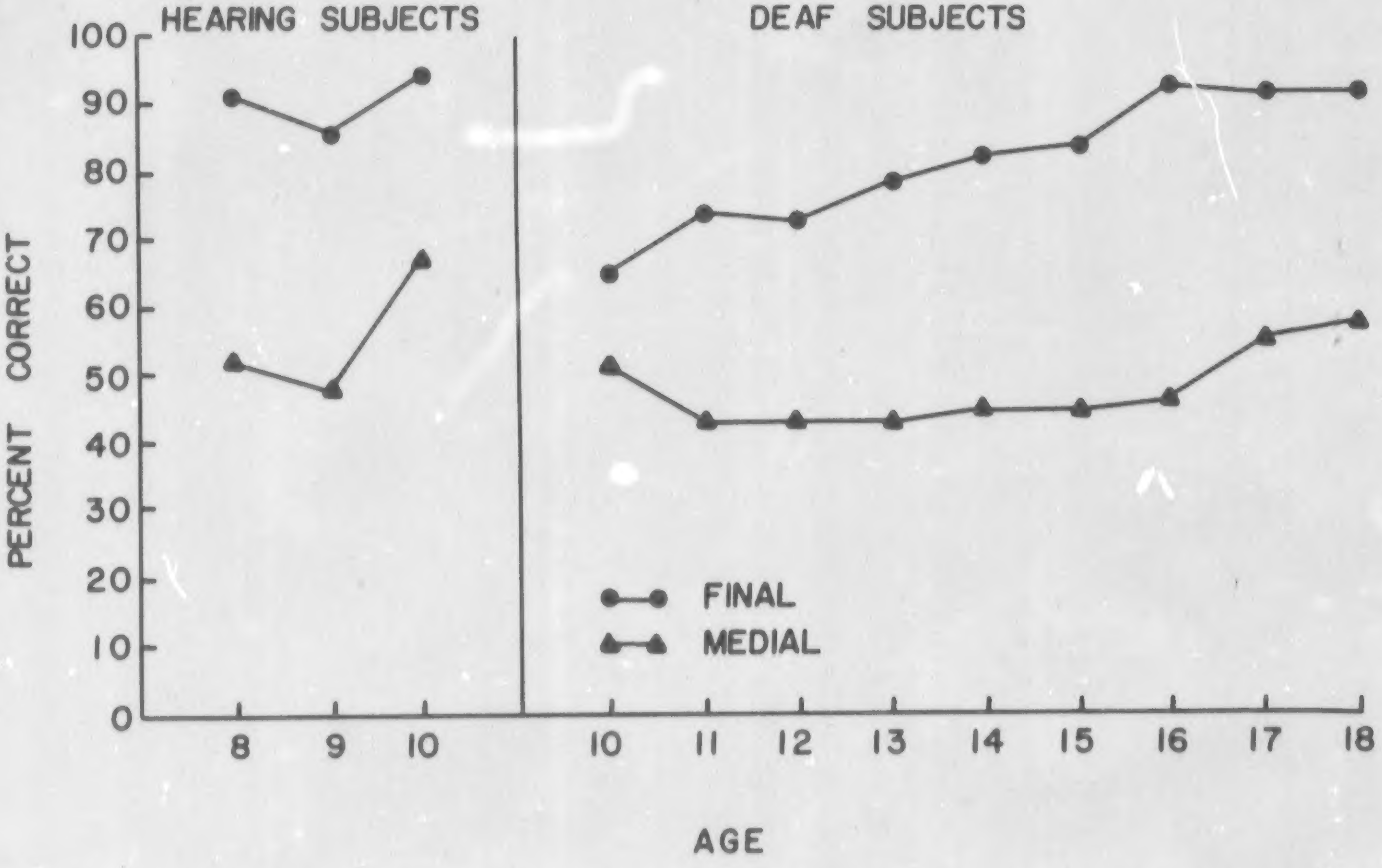


Figure 11. Responses on medial position items and final position items of the Processing subtest

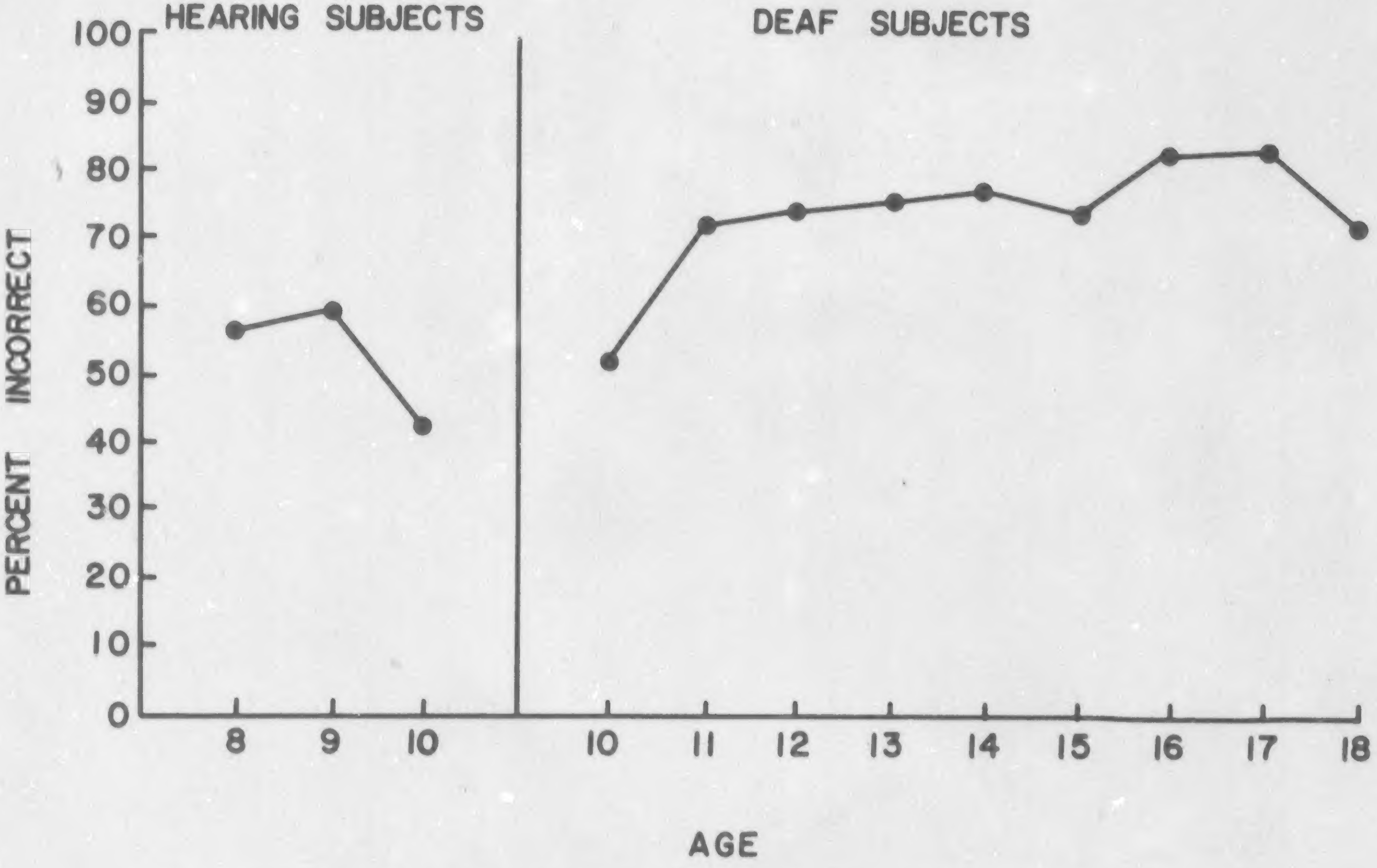


Figure 12. Responses to selected items of Processing subtest indicating surface order reading of items

2. The man who bought a dog chased the woman.

a. The man chased the woman. yes____ no____

b. A dog chased the woman. yes____ no____

In order to respond correctly to these items, the student must make an association between the NP and VP of the main sentence, although they are separated by a medially placed relative clause. What apparently happened instead, with most deaf students, was that they associated the NP and VP which were closest together, resulting in the incorrect responses. As Figure 12 shows, 73% of the responses of deaf students at 11 years of age were incorrect and the percentage at 18 years was still 73, indicating no improvement over a period of seven years. Hearing students also had difficulty interpreting these two items, with 57% incorrect responses at 8 years old and 41% incorrect at 10 years. While the performance was better than for the deaf students, these figures indicate that the hearing students were having considerable difficulty in comprehending sentences with medially placed relative clauses at an age when they would be expected to encounter such sentences in their school materials.

Embedding

Figure 13 shows the age differences in overall results of the Embedding subtest. As expected, the hearing students did much better than the deaf students, with the mean score for the youngest group of hearing students (approximately 80% correct at 8 years of age) exceeding the mean score for the oldest group of deaf students (59% correct at 18 years of age).

In written language deaf individuals often inappropriately delete a NP (subject or object) in the embedded sentence. For example, given the sentences The dog chased the girl and The girl had on a red dress, some deaf persons accept The dog chased the girl had on a red dress as a properly embedded version of the sentences. In this case, the individuals are considered to be inappropriately deleting the subject of the embedded sentence in identity with the object of the main sentence (object-subject deletion). As another example, given the sentences John chased the girl and He scared the girl, some deaf individuals accepted John chased the girl and he scared. In this case, the object of the second sentence, coreferential with the object of the main sentence, was incorrectly deleted (object-object deletion).

Figure 14 shows the means by age for both deaf and hearing students for correct rejection (as ungrammatical) of sentences which had undergone object-subject deletion (12 items, r = .667) and object-object deletion (5 items, r = .607). It can be seen

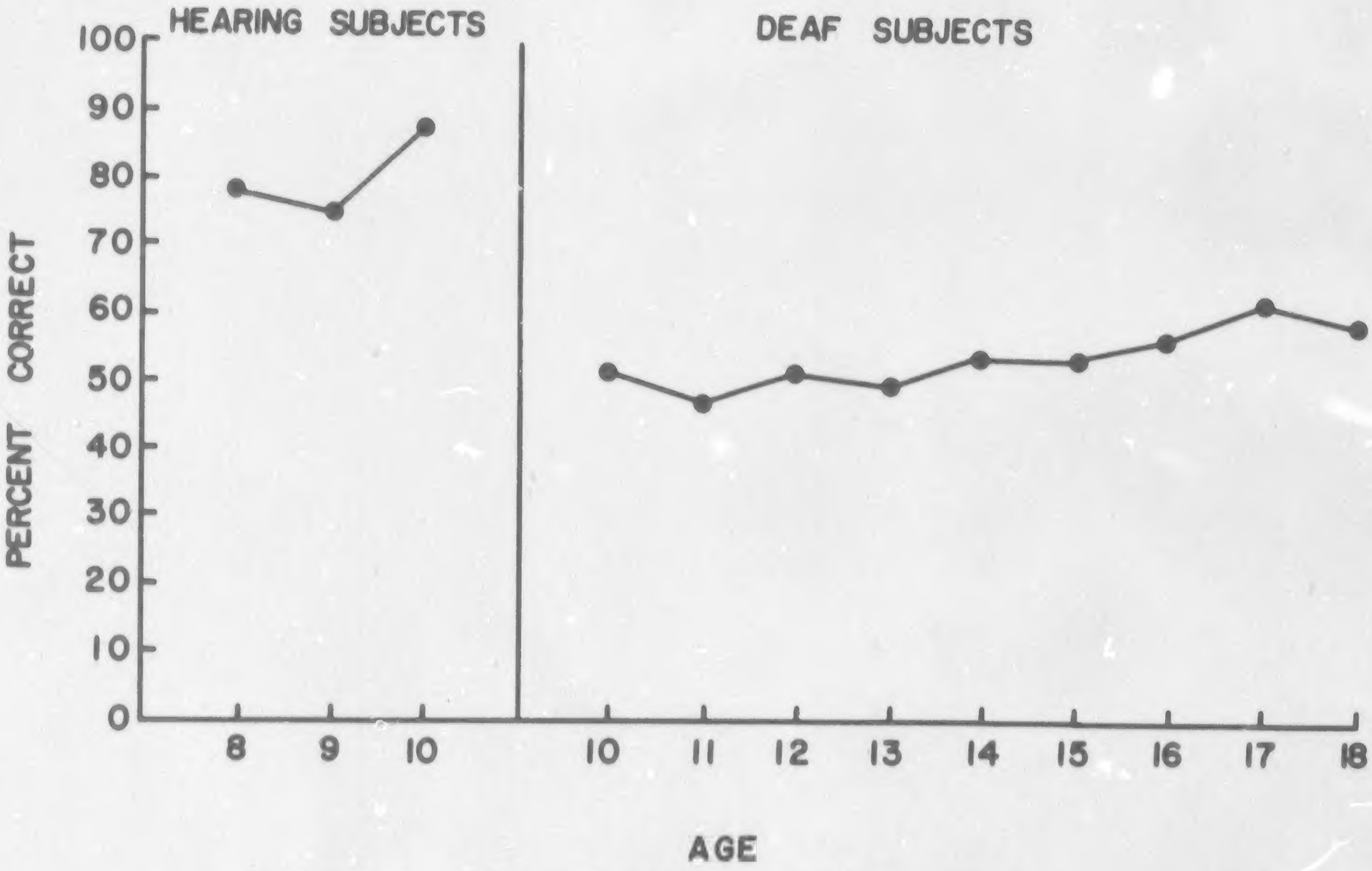


Figure 13. Overall results of the Embedding subtest

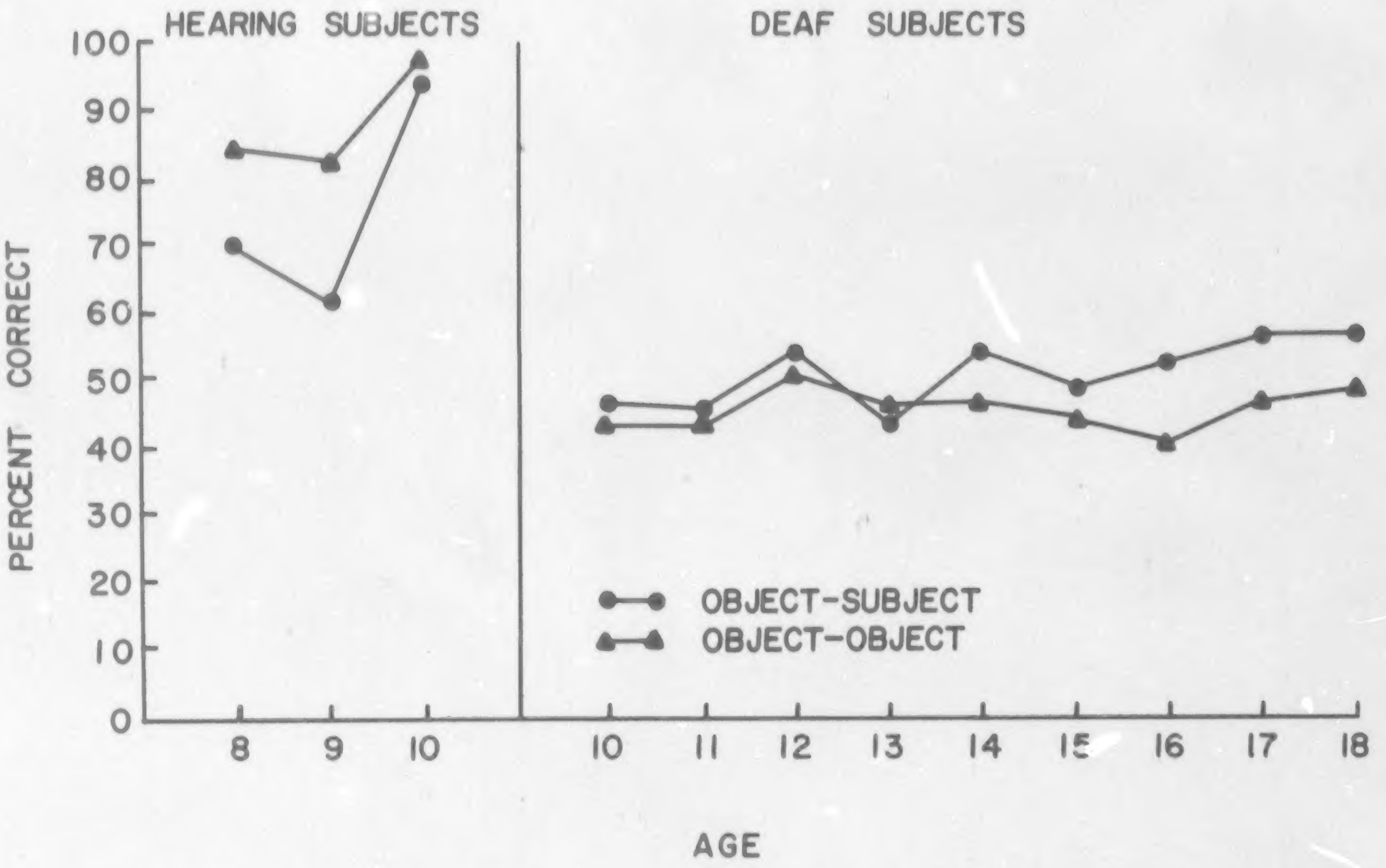


Figure 14. Correct rejection of object-subject deletion and object-object deletion on the Embedding subtest

that hearing subjects had some difficulty with these items at 8 and 9 years of age but had effectively mastered them by age 10. The deaf students, however, had great difficulty with these items all through the age range tested. Age differences for deaf students on the object-subject deleted items were significant, $F\ (8,419) = 2.05$, $p < .05$, indicating some improvement with age, although mean percent correct responses improved only from about 47% in the 10-11 year age range to 56% in the 18-year-old age group. Age differences for the deaf students on the object-object deleted items were not significant, with group means ranging from approximately 44% correct at 10-11 years to 49% correct at 18 years. While hearing students had little difficulty rejecting these incorrect syntactic structures, they remained acceptable to deaf students throughout the age range tested.

Another deviant pattern found in the written language of deaf persons and examined here was the use of incorrect forms of the possessive in relative clauses. Some items in this subtest were used to study this pattern. For example:

A. I helped the boy. The boy's mother was sick.

The sentence means the same as A.

I helped the boy mother was sick. yes___ no___
I helped the boy's mother was sick. yes___ no___
I helped the boy whose mother was sick. yes___ no___

Such items measured the extent of acceptance by the subjects of the appropriate form of the possessive, whose, and the extent of rejection of forms which are inappropriate but nevertheless used by deaf students in their written language. Subscores were computed reflecting acceptance of sentences with the proper form of the possessive, whose (2 items, $r = .582$); rejection of sentences with incorrect possessives (NP's when whose was required; 2 items, $r = .631$); and rejection of sentences containing no possessive at all when whose was required (2 items, $r = .567$). Differences among the group means for deaf and hearing students are shown in Figure 15. There were significant age differences and significant linear trends for whose subscores, $F\ (8,419) = 6.72$, $p < .001$, and no possessive subscores, $F\ (8,419) = 7.31$, $p < .001$, but no significant age differences for the NP's subscores. Thus, as deaf students grow older they learn to recognize and accept the proper form of the possessive, whose, in relative clauses. They also learn to recognize as ungrammatical those sentences in which the possessive is required but not used. But they apparently do not learn to recognize as ungrammatical those sentences containing the possessive form NP's where whose is required. They also continue to use this form in their written language.

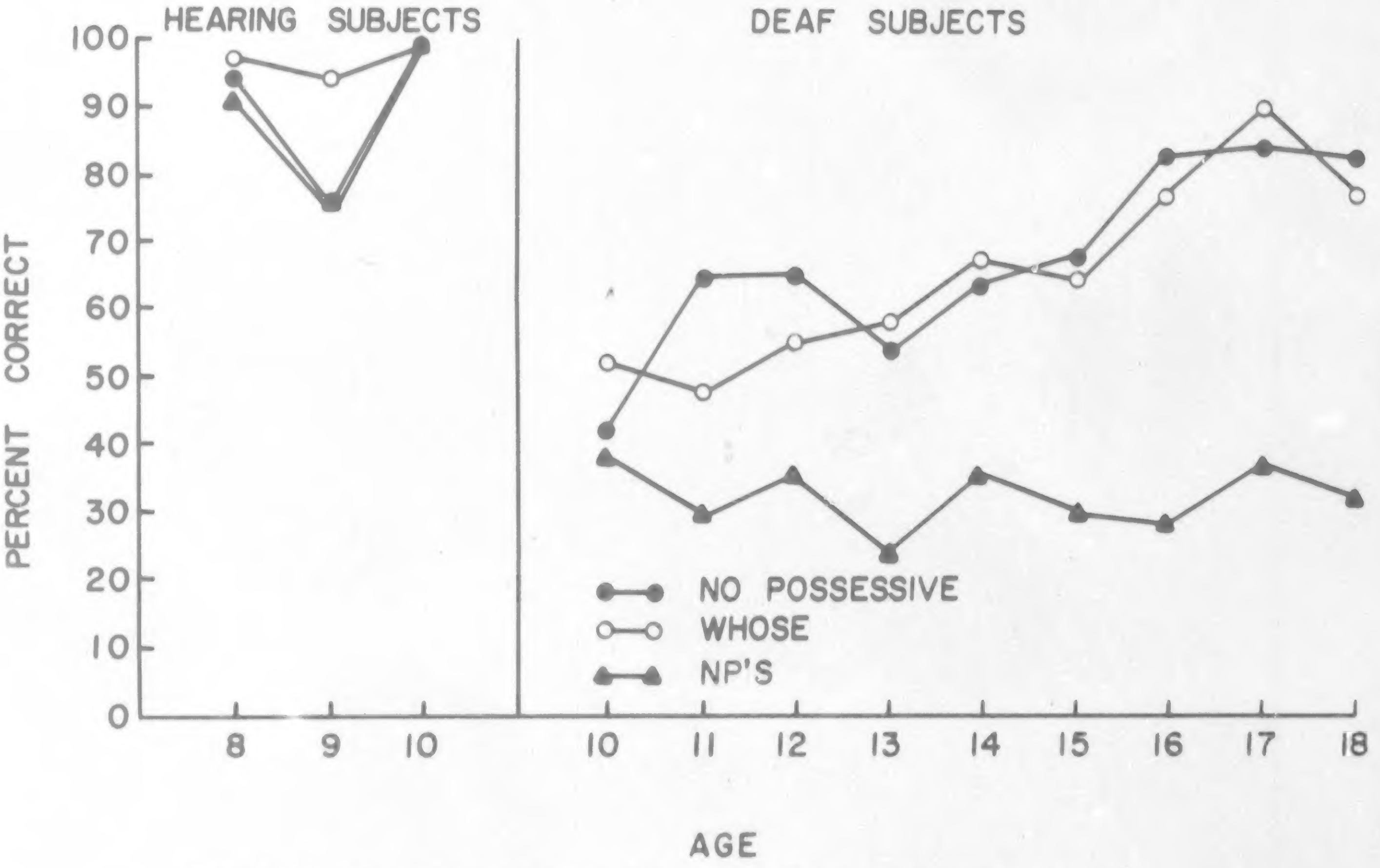


Figure 15. Responses to possessive items of the Embedding subtest

Copying

The Copying subtest was designed to study a particularly frequent "deviancy" in the written language of deaf individuals--use of the referent noun phrase after the relative pronoun rather than deleting it as in Standard English (e.g., *John saw the boy who the boy kicked the ball*). On the surface, this looks as though the NP had been "copied" after the coreferent relative pronoun. Figure 16 shows the percent of items correct for the total subtest, the percentage of acceptance of correct items on the subtest (e.g., *John saw the boy who kicked the ball*; 10 items, r = .618), and the percentage of acceptance of incorrect items on the subtest (e.g., *John saw the boy who the boy kicked the ball*; 20 items, r = .921). It can be seen that the total correct for the deaf students increased with age from 45% at age 10 to 69% at age 18. The age differences and the linearity of trends were significant (see Table 11). As can be seen in Figure 16, improvement in the total score resulted entirely from the decreased acceptance of incorrect sentences, which declined significantly, F (8,419) = 12.71, $p < .001$, from 62% to 24%, rather than to an improved ability to accept correct sentences. In fact, acceptance of correct sentences actually declined slightly, although not significantly, from 61% at 10 years of age to 55% at 18 years of age. The problem of comprehending correct relative sentences of this type, therefore, remained persistent throughout the age range tested.

Written Language Sample

The students' order of difficulty with respect to relative pronoun type and relative clause position as demonstrated by the TSA were confirmed by the analysis of the written language samples. Subject relative clauses outnumbered object relatives five to one, with subject relatives comprising 84% of the total and object relatives only 16%. Nine percent of the deaf students produced one or more subject relatives, while those in object position were used by only 2% of the students. Similarly, approximately twice as many final relatives (68% of the total) were produced as were medial relatives (32%); 11% of the deaf sample used at least one final relative, while medial relatives were used by only 6%. Differences were even more striking for the hearing students. No hearing students used object relatives, while subject relatives were used by 15% of the sample; final relatives comprised 76% of the total (produced by 17% of the students), as opposed to medial relatives which comprised only 24% (7% of the students).

Object-object deletion and *object-subject* deletion were infrequently applied by 22% of the deaf students scattered over all

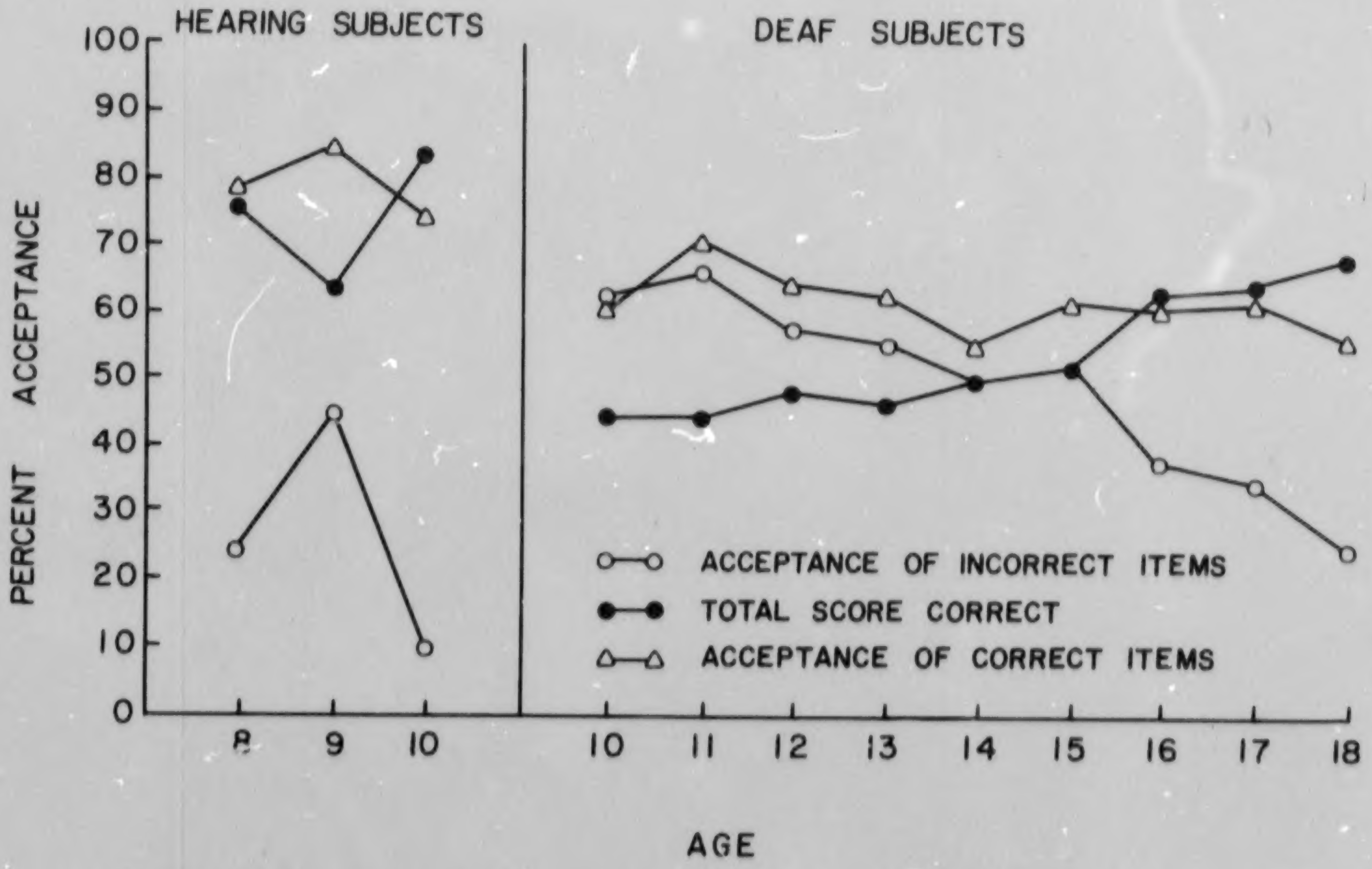


Figure 16. Acceptance of correct and incorrect items on the Copying subtest

ages, and neither was produced by any of the hearing students. A more detailed analysis of object-subject deletion and object-object deletion in the written language sample will be presented in a later chapter dealing with Conjunction.

Although instances of relative copying were found in the earlier study (Marshall and Quigley, 1970), and although it is clear from the TSA results that this is a structure which causes deaf students considerably difficulty, no instances were found in the present written language sample.

Discussion

The results of the study indicate the general difficulty which prelingually deaf persons have in achieveing comprehension of relativized sentences and some of the particular problems they have with those structures. Since relativization is one of the major ways in which two or more sentences can be combined into a more complex sentence, it is of major importance in the development of mature language. The difficulty deaf students have in understanding relativized sentences is demonstrated by the existence of regular patterns in the deviant structures they produce. Those deviant patterns which were found in the written language of deaf persons and were examined through the relativization subtests, were: object-subject deletion; object-object deletion; incorrect forms of the possessive; and the copying phenomenon. The results indicated that these patterns were present in the comprehension as well as the production of language by deaf persons. The copying phenomenon and one of the inappropriate possessive forms tended to diminish in frequency with age for the deaf students, but object-subject deletion, object-object deletion, and one inappropriate possessive form tended to persist almost unchanged in frequency over the entire age range of deaf students.

Power and Quigley (1973) pointed out the tendency of deaf students to interpret passive sentences in terms of the surface subject-verb-object (SVO) order of constituents, thus misinterpreting passive sentences as active sentences. Students in the present study showed a similar tendency toward surface order reading with relativized structures, as indicated by the data on medially embedded relative clauses. It is almost as if deaf students, even at 18 years of age, have a basic SVO sentence pattern into which they try to fit all sentences they read.

The fact that some of the error patterns continued to exist along with correct forms of the same syntactic structures suggests that some deaf students might possess two or more parallel sets of rules for the generation of certain syntactic structures. Perhaps the clearest illustration of this in the relativization data is the results from the use of the possessive. Older deaf students increasingly learned to recognize correct forms of the possessive in relativized sentences such as I helped the boy whose mother was sick, and to reject incorrect forms without a possessive marker, such as I helped the boy mother was sick. But the majority of deaf students throughout the entire range readily accepted forms with incorrect possessive markers, such as I helped the boy's mother was sick. The 8-year-old hearing students rarely accepted this type of sentence and the 10-year-old hearing students never did. As was pointed out earlier in this chapter, this particular deviant pattern, as well as most of the other such patterns tested, was of frequent occurrence in the written language of deaf persons. Thus, deaf students tended to produce and accept such sentences as I helped the boy's mother was sick, while at the same time producing and accepting correct relatives such as I helped the boy whose mother was sick.

A major question which arises from these data is whether the presence of specific deviant patterns in the written language of deaf students implies that the rules which would generate these patterns differ substantially from those used by hearing students as they pass through developmental stages in the acquisition of English. The teaching problem would be quite different if deafness imposed restrictions on the acquisition of language by deaf students which differed from those involved in the acquisition of languages, such as English, rather than differing from that of hearing students only in the rate at which it is acquired. The fact that all of the deviant structures examined by the relativization subtests (object-subject deletion, object-object deletion, relative copying, and reading surface order) were accepted as correct by at least a few hearing students tends to substantiate the retardation-in-rate point of view. It should be borne in mind, however, that the youngest hearing students were of an age (8 years old) where a simple lack of reading skills might have been responsible for their acceptance of these deviant structures. This difference of degree is also demonstrated by the fact that both deaf and hearing students showed the same relative differences for relative clause position and type; final clauses were easier than medial ones, and subject clauses easier than object clauses, for both groups.

Since deaf children's acquisition of relative clause rules is much slower than that of hearing children, it is interesting to consider the results of the reader analysis which was done of the Reading for Meaning series (McKee, et al, 1966). It was found that relative clauses first appeared in the second primer and gradually increased up to the sixth grade reader, where they appeared in 12 out of every 100 sentences. It is obvious that with this many relative clauses, deaf students must be misunderstanding the textbooks and other reading materials they are expected to use. The difficulty deaf students have in understanding relativized sentences, even at 18 years of age, is one indication of the need for control of syntactic structure in reading and other curriculum materials used with these students. Furthermore, many of the hearing subjects in the present study had enough difficulty understanding some types of relativized sentences to indicate that control of syntactic structure might also be an important consideration in reading materials for hearing students.

CHAPTER 6

CONJUNCTION

The process of conjunction, by which two or more sentences are combined into one compound sentence, is one of three "recursive" processes which make possible the generation of an infinite number of sentences from a finite number of rules, the other two processes being relativization and complementation. In English, two or more sentences may be combined into one compound sentence by conjuctions such as and, or, and but. In the most general case, two sentences such as Mary is going home. I will meet her there, are equivalent to a sequence of the two joined by and; Mary is going home and I will meet her there. If the two sentences contain like elements, repetition of those elements is often avoided, either by deleting one occurrence or by pronominalizing. The process of deletion to avoid redundancy in this case is referred to as conjunction reduction. Two sentences with identical subjects (Ellen woke up late. Ellen missed her train) can be simply conjoined with and (Ellen woke up late and Ellen missed her train), conjoined with pronominalization (Ellen woke up late and she missed her train), or reduced by a rule of conjunction reduction to a sentence containing a conjoined verb phrase (Ellen woke up late and missed her train). In like manner, two sentences with identical parts may be conjoined using conjoined noun phrases (in subject or object position), conjoined adjectives, conjoined adverbs, etc. Within the framework of transformational generative grammar, many of these conjoined structures are assumed to be derived from full conjoined sentences by the process of conjunction reduction. This theoretical assumption has received support from the findings of Menyuk (1963, 1964) that hearing children in the process of acquiring English produce fully conjoined sentences at an earlier age than reduced conjoined phrases, but do not show any differences in production of conjoined noun phrases, adjectives, or verb phrases.

Conjunction reduction in Standard English is subject to two important constraints. One of these specifies that the application of the rules must produce a sentence which has as its initial or final (but not medial) element the word or phrase which was identical in both sentences before the sentences were reduced. For example, from John bought some lemons. John went home, a well-formed sentence is derived with conjoined verb phrases and John in the initial position: John bought some lemons and went home. Similarly, John washed the car. Bill washed the car gives, John and Bill washed the car, with conjoined noun phrases and the identical element washed the car at the end of the sentence. The second constraint states that before the rules of conjunction reduction can apply, the identical element in each of the two unconjoined sentences must have had the same function. That is, they must have both been subjects, or both objects, or both predicates, and so on.

Violations of these two constraints on conjunction reduction, along with the omission of and from conjoined sentences (A man kicked a dog hurt it), have been found in previous studies of the written language of deaf students (Quigley, 1969). For example, from the sequence, John threw the ball. Mary dropped the ball, deaf students frequently produced a conjoined structure, such as John threw the ball and Mary dropped. Here, the identical element, the ball, is in medial position in the conjoined sentence. The rule producing this structure has been termed in this report object-object deletion: The object of the second sentence (the ball) has been inappropriately deleted because it is identical to the object of the first sentence (the ball). When a deaf child produces The boy saw the turtles and ate the fish, from stimulus pictures which show The boy saw the turtles. The turtles ate the fish, he has deleted the second occurrence of the turtles on identity to the first occurrence of the turtles, possibly because he feels its repetition is redundant. However, the first occurrence of the turtles is the object of the first sentence, and the second occurrence of the turtles is the subject of the second sentence, so his conjoined sentence violates the second constraint on conjunction reduction. This is referred to in this report as object-subject deletion.

Results

This chapter reports the systematic investigation of judgments of grammaticality and production of conjoined structures (and the use of and) in various sentence environments. Test items were generated on the basis of theoretical descriptions of these structures as well as from the various consistent syntactic deviations found previously in the written language of deaf persons. These results are based on the scores of the three conjunction subtests and on combinations of certain items within the subtests. Multivariate analysis of variance was used to determine the appropriate univariate F's and significance levels for all the analyses reported. All F's and significance levels for age differences and linear trends are given in Table 12.

Judgments of Grammaticality

Conjoined structures. The ability of deaf students to judge the grammaticality of non-reduced conjoined sentences (e.g., The lady picked the flowers and the man cut the grass) increased significantly over age, as can be seen in Table 13. Hearing students also tended to make more correct grammaticality judgments of non-reduced conjoined structures as their age increased (see Figure 17).

Table 12

_F_ tests and Significance Levels for Age Differences and Linear Trends for Deaf Subjects

Syntactic structure	Age			Linear trend		
	_F_	df	_p_	_F_	df	_p_
Conjoined sentences						
Judgments of Grammaticality	10.76	8,463	**	79.71	1,463	**
No Common Elements	4.33	8,407	**	31.48	1,407	**
Object-Object Deletion Environment	5.03	8,407	**	34.65	1,407	**
Object-Subject Deletion Environment	1.41	8,407	NS	6.56	1,407	*
Deviancies in Conjoined Sentences						
Object-Object Deletion	1.48	8,406	NS	6.91	1,406	*
Object-Subject Deletion	1.35	8,406	NS	7.02	1,406	*
And-Deletion	9.98	8,463	**	67.41	1,463	**
Conjunction Reduction						
Conjoined Subjects	5.32	8,407	**	36.22	1,407	**
Grammaticality Judgments-Subjects	7.94	8,463	**	48.00	1,463	**
Conjoined Objects	5.45	8,407	**	35.16	1,407	**
Grammaticality Judgments-Objects	7.09	8,463	**	49.15	1,463	**
Conjoined Verb Phrases	6.83	8,407	**	50.43	1,407	**
Grammaticality Judgments-Verb Phrases	9.20	8,463	**	70.51	1,463	**
And-Deletion Deviancies in Conjunction Reduction						
Conjoined Subjects	9.29	8,463	**	62.92	1,463	**
Conjoined Objects	10.68	8,463	**	74.71	1,463	**
Conjoined Verb Phrases	6.27	8,463	**	39.80	1,463	**

Table 12 (continued)

Syntactic structure	Age			Linear trend		
	F	df	p	F	df	p
Disjunction and Alternation						
Disjunction in Conjoined Sentences	9.36	8,457	**	59.74	1,457	**
Disjunction in Conjoined Adjectives	5.84	8,457	**	33.44	1,457	**
Alternation with Conjoined Subjects	4.93	8,457	**	108.66	1,457	**
Alternation with Conjoined Objects	13.29	8,457	**	88.70	1,457	**
How Many?	4.47	8,457	**	25.55	1,457	**

** $p < .001$
* $p < .01$

Table 13

Percent Correct Scores for Judgments of Grammaticality for Conjunction and Conjunction Reduction Subtests and Item Subgroup Reliabilities

			Hearing students			Deaf students								
			Age			Age								
	# items	r	8	9	10	10	11	12	13	14	15	16	17	18
Non-reduced conjoined structures	4	.440	90	80	96	60	63	67	70	80	74	87	86	87
Conjoined subjects	4	.504	90	82	92	53	68	73	72	77	76	84	87	80
Conjoined objects	4	.463	91	86	100	63	66	68	74	76	80	88	86	81
Conjoined verb phrases	4	.403	92	89	100	57	61	63	68	70	71	81	84	84

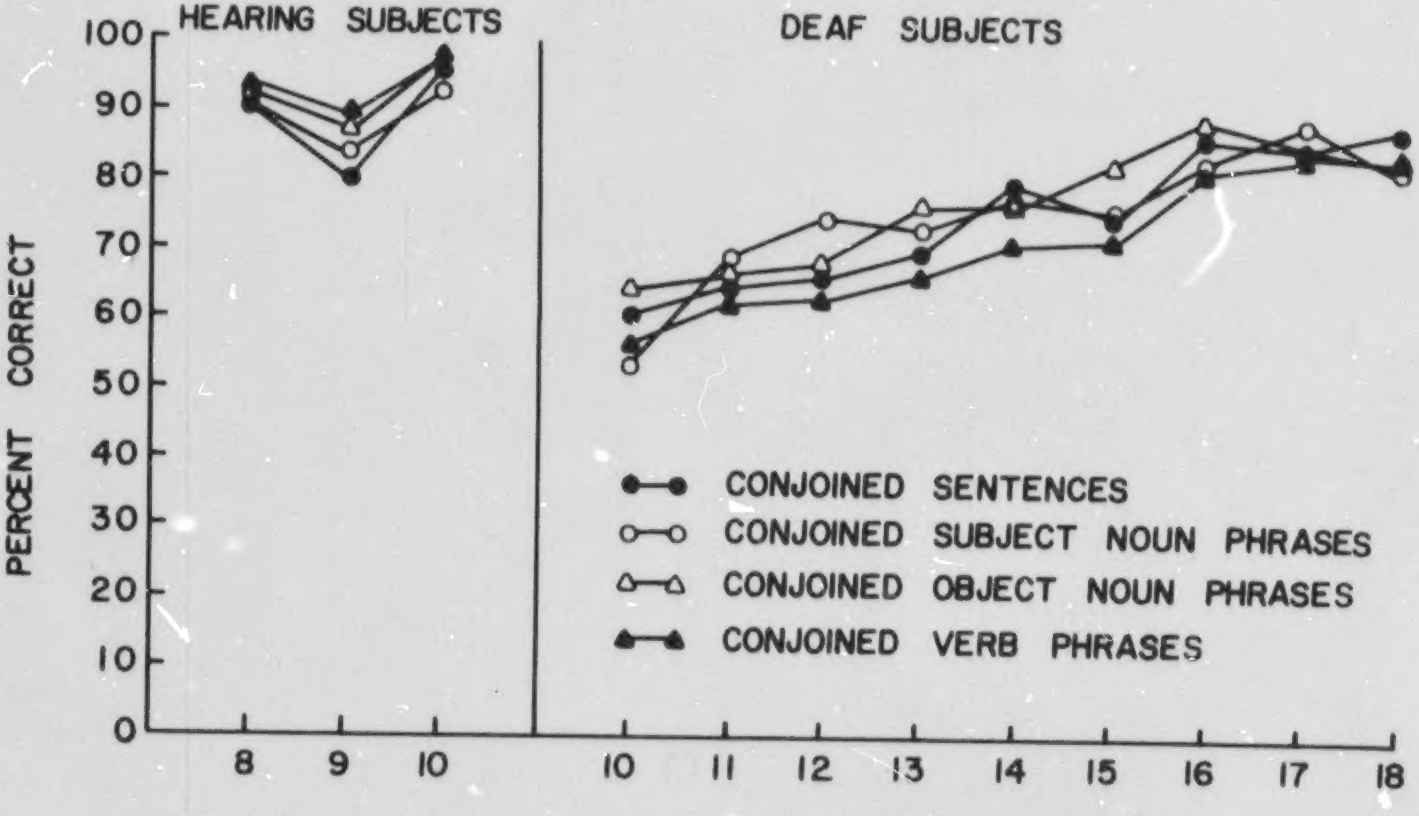


Figure 17. Judgments of grammaticality for conjoined structures

When asked to judge the grammaticality of sentences with conjoined subjects (e.g., *A man and a woman danced*), deaf students were correct in their judgments 53% of the time at age 10, improving to 80% at age 18. Hearing students' judgements of the same items were 90% correct at age 8 and 92% correct at age 10. Judgments of grammaticality of sentences with conjoined objects (e.g., A lady bought *a coat and a hat*) increased from 63% correct at age 10 to 82% correct at age 18 for deaf students. Hearing students had little difficulty in making judgments of grammaticality in this environment, with scores of 91% at 8 years of age and 100% at 10 years of age. Deaf students' judgements of the grammaticality of conjoined verb phrases (e.g., Mother *bought* a fish and *cooked* it) increased from 57% correct at age 10 to 84% correct at age 18. Hearing students were correct in their judgements of grammaticality 92% of the time at age 8 and 100% at age 10.

And-deletion. One of the common deviant conjunction forms found in the written language of deaf children is conjoined structures without *and*, such as *A boy a girl went home*. The rule producing such structures will be referred to here as *and deletion*. When asked to make judgments of grammaticality of conjoined sentences of this type, deaf students incorrectly accepted the deviant form 56% of the time at age 10, with a decrease to 21% by age 18. As can be seen in Figure 18, for all three types of reduced structures (conjoined subjects, objects and verb phrases) there was a significant decrease in the incorrect acceptance of *and-deleted* structures with age. Conjoined noun phrases (subject or object) without *and* were incorrectly accepted 54% of the time by 10-year-olds, but only 22% of the time by age 18. For conjoined verb phrases without *and*, the values were 54% at age 10 and 31% at age 18. However, conjoined verb phrases without *and* were accepted significantly more often than either conjoined subjects, $F\ (1,463) = 35.21$, $p < .001$, or conjoined objects $F\ (1,463) = 32.63$, $p < .001$, across all ages.

Comparison of *and-deletion* in the four structures for the deaf subjects revealed that *and-deletion* in conjoined sentences, conjoined subjects, and conjoined objects did not differ significantly from each other but all did differ significantly from conjoined verb phrases. Deaf subjects had more difficulty judging grammaticality of *and-deleted* verb phrases $F\ (1,463) = 20.83$, $p < .001$.

Hearing students were much less likely to accept *and-deleted* structures than were deaf students, and the order of acceptance of *and-deleted* structures was somewhat different than that of deaf students. Hearing students were more likely to accept *and-deletion* in conjoined sentences or in sentences with conjoined subjects than in sentences with conjoined objects or conjoined verb phrases.

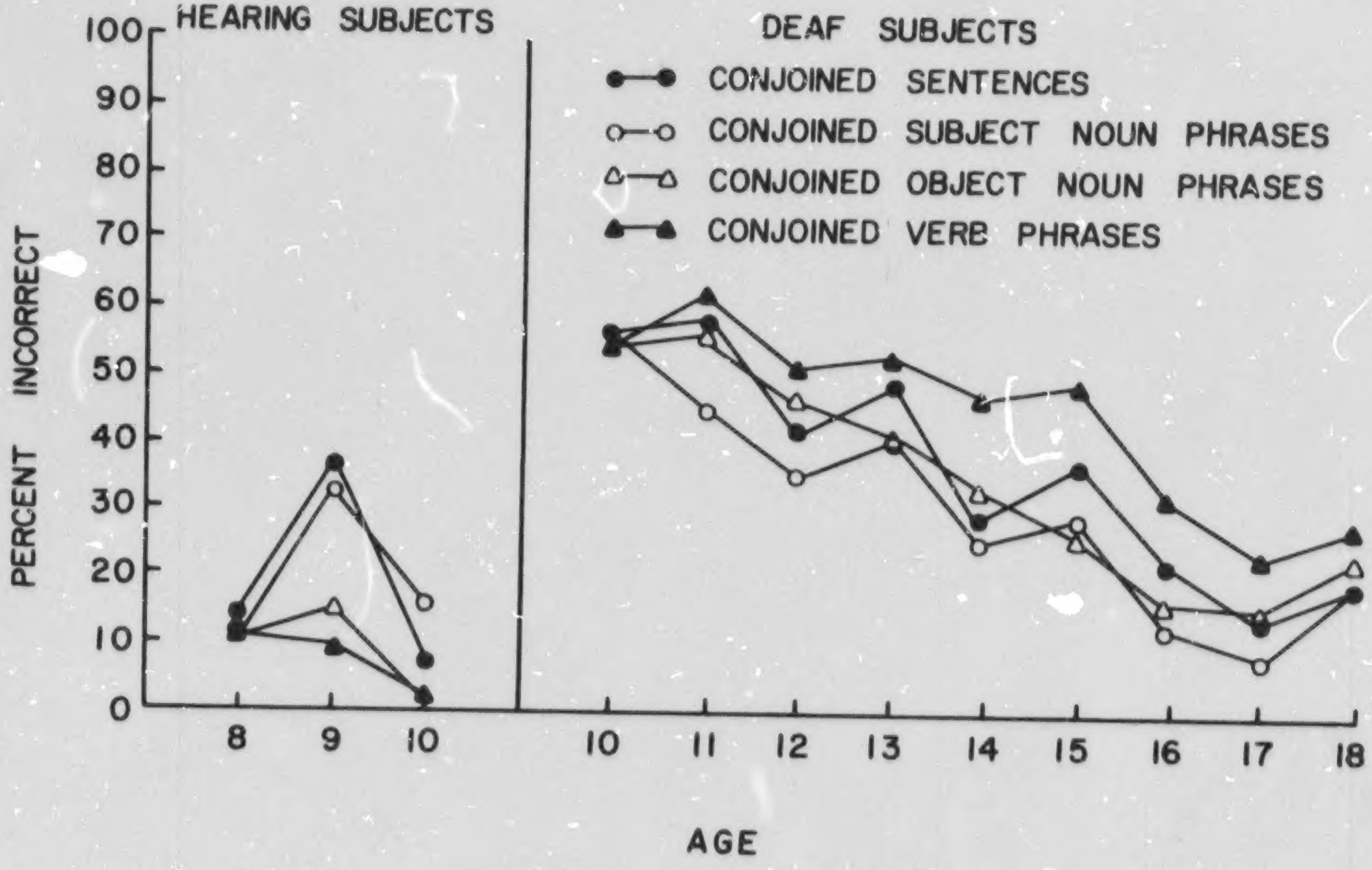


Figure 18. Incorrect acceptance of *and*-deleted sentences

Production of Conjoined Structures

Conjoined sentences. Actual production of conjoined structures proved to be a more difficult task for the subjects than judging the grammaticality of structures. When presented with two simple sentences and asked to produce a conjoined sentence, students' abilities varied with the relationship between the two sentences. If the sentences had no common elements (e.g., *The boy ran home. The girl went to school*), deaf students at age 10 produced correct unreduced conjoined sentences (e.g., *The boy ran home and the girl went to school*) only 46% of the time, increasing to 76% at age 18.

As Figure 19 shows, when the two stimulus sentences had identical objects (the environment for *object-object deletion*) (e.g., A man lost *a watch*. A boy found *a watch*), 10-year-olds were able to conjoin the two sentences correctly (*A man lost a watch and a boy found it*) only 25% of the time. Students improved significantly with age so that by age 18 they were correct 68% of the time. When the environment for *object-subject deletion* existed (e.g., *Bill kicked the dog. The dog bit him*), correct conjoining (e.g., *Bill kicked the dog and it bit him*) increased only slightly, from 44% of the time at age 10 to 45% at age 18. The difference between the students' performance on stimuli with no elements in common and those with identical elements (*object-object* or *object-subject*) was significant, $F\ (1,407) = 99.65$, $p < .001$, as was the difference between *object-subject* and *object-object* environments, $F\ (1,407) = 15.92$, $p < .001$, and their interaction with age $F\ (8,407) = 2.82$, $p < .005$.

On the production tasks, the 8 and 10-year-old hearing children were 91% and 78% correct respectively, when conjoining sentences with no common elements. For hearing students, sentences with identical objects resulted in more errors (79% correct at age 8 and 85% correct at age 10) than did stimulus sentences in which the subject of the second sentence was identical to the object of the first (88% both at age 8 and at age 10), $F\ (1,56) = 15.21$, $p < .05$.

Conjoined phrases. When given two sentences with identical verb phrases (e.g., *A dog chased a ball. A cat chased a ball*) to conjoin, deaf students correctly produced conjoined subject noun phrases (*A dog and a cat* chased a ball) 34% of the time at age 10 and 81% of the time at age 18 (see Figure 20). At the same time 10-year-old deaf students produced unreduced conjoined sentences (*A dog chased a ball and a cat chased a ball*) in 17% of their responses, whereas 18-year-old deaf students' responses included only 5% unreduced conjoined sentences. Eight-year-old hearing students produced the appropriate conjoined subject noun phrases

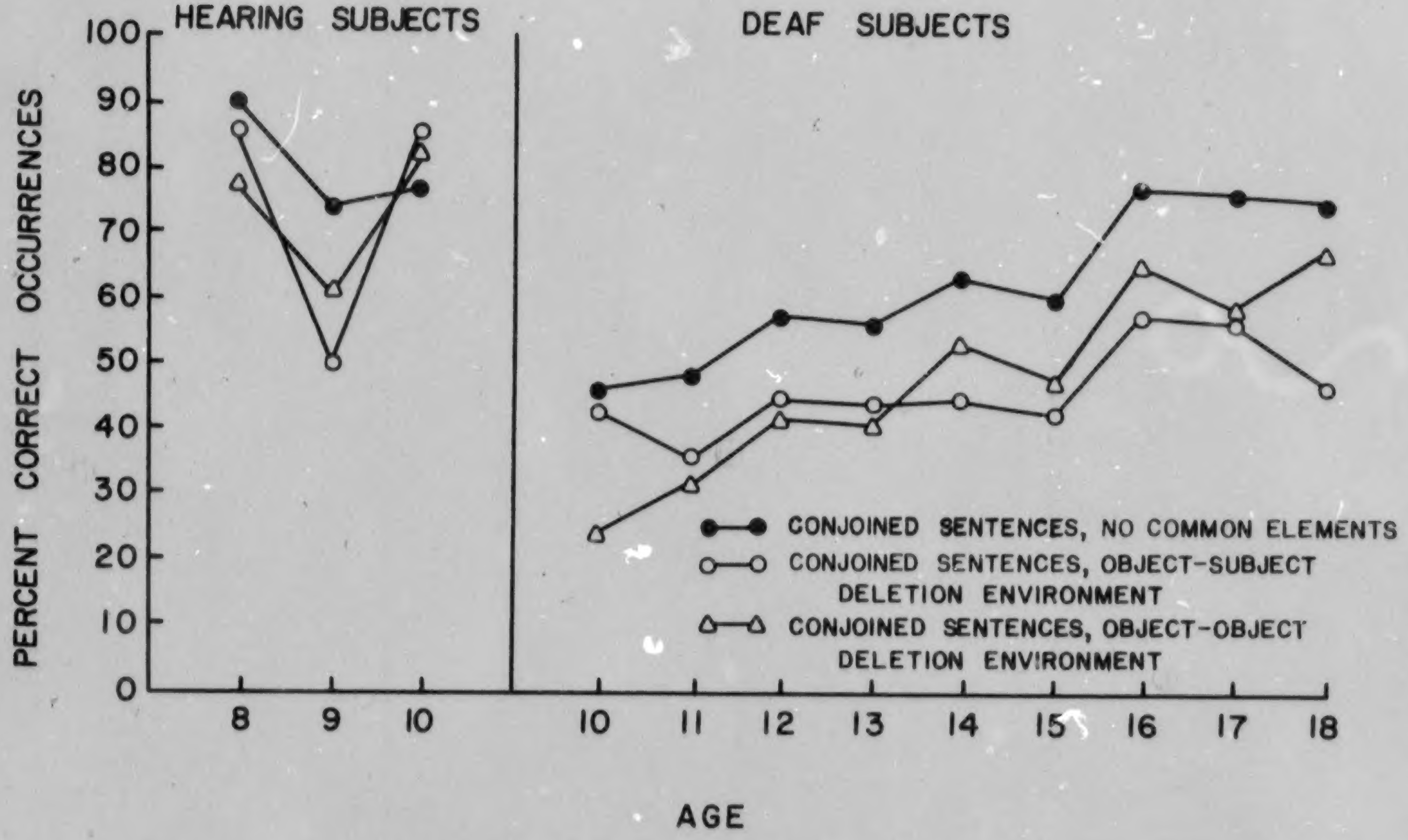


Figure 19. Production of correctly conjoined structures in three different conjunction environments

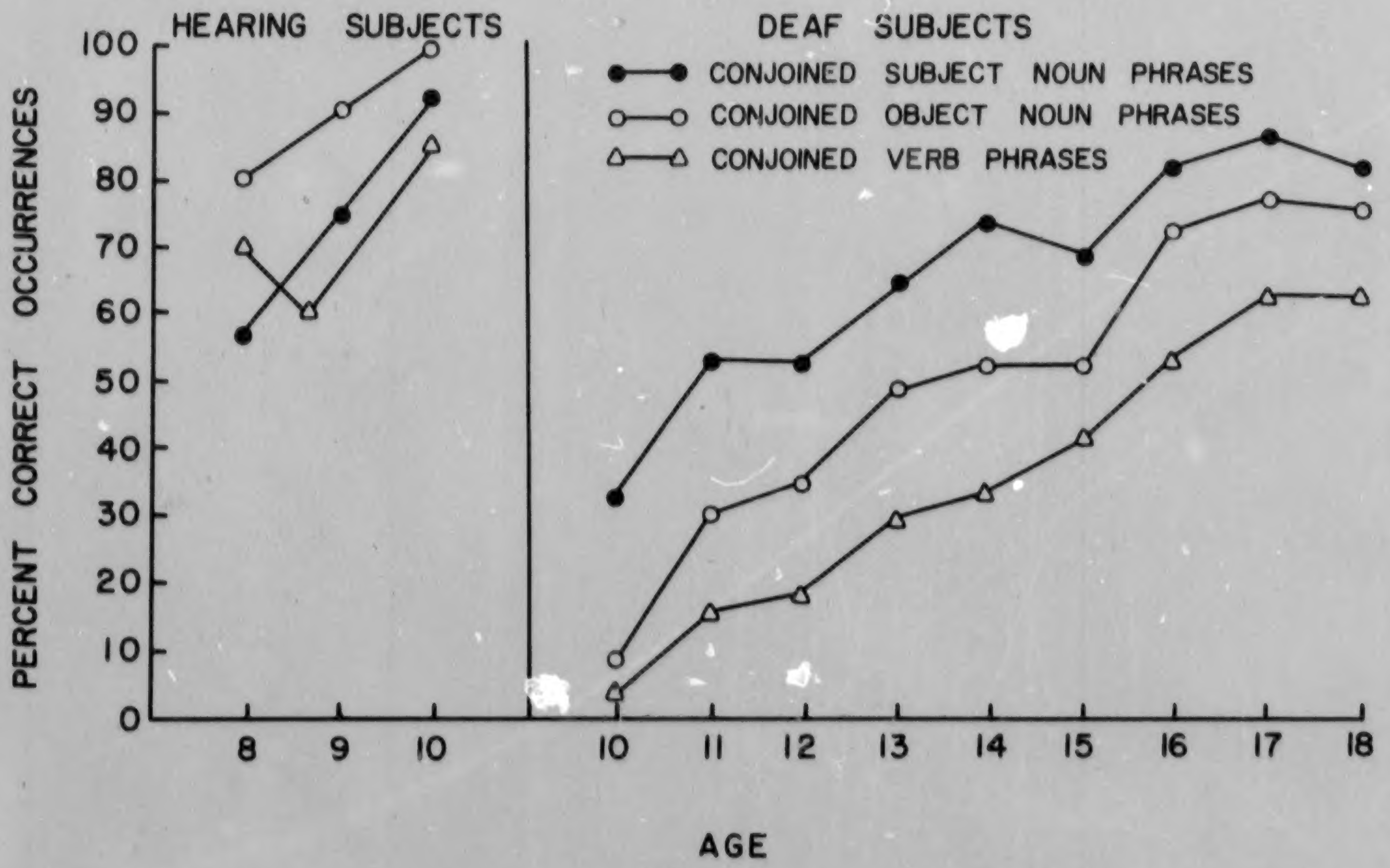


Figure 20. Production of correctly conjoined structures with appropriate conjunction reduction

in 58% of their responses and unreduced conjoined sentences in 31% of their responses. The 10-year-old hearing students produced conjoined subject noun phrases in 94% of their responses and conjoined sentences in only 4% of their responses.

Presented with two sentences with identical subjects (e.g., *A man stole a purse*. *A man stole a T.V.*), deaf students at age 10 produced correct conjoined object noun phrases in only 7% of their responses, while producing grammatical but unreduced conjoined sentences in 40% of their responses. Correct conjoined object noun phrases increased from 77% of the responses of the 18-year-old deaf students, while unreduced conjoined sentences declined to 7% of the responses at that age. Hearing students had little difficulty producing conjoined object noun phrases (81% at age 8 and 99% at age 10), and produced relatively few unreduced conjoined sentences in this environment (18% at age 8 and 1% at age 10).

Deaf students were able to correctly conjoin sentences with both identical subjects and identical objects of the form (e.g., *The boy* dropped *the ball*. *The boy* lost *the ball*) with conjoined verb phrases (The boy *dropped* the ball and *lost* it) only 3% of the time at age 10, increasing to 62% at age 18. At the same time, deaf students produced unreduced conjoined sentences (e.g., *The boy dropped the ball and he lost it*) in this environment in 27% of their responses at age 10 and in 15% of their responses at age 18. Hearing students produced conjoined verb phrases (70% and 86% at ages 8 and 10, respectively) much more often than unreduced conjoined sentences (20% to 5%) in this environment.

Object-subject deletion and object-object deletion. Inclusion of items satisfying the environments for *object-object deletion* or *object-subject deletion* in the Conjunction test provided an opportunity to test for specific deviant patterns which had previously been found in the written language of deaf students. In the *object-object deletion* environment (e.g., A boy threw *a ball*. A girl caught *the ball*), deviant structures (*A boy threw a ball a girl caught*) were actually produced 6% of the time at age 10, with a gradual decrease to 1% at age 18 (see Figure 21). The age differences were not significant, although the linear trend was. In the *object-subject deletion* environment (e.g., A boy kicked *a cat*. *The cat* ran away) deviant deletions (*A boy kicked a cat ran away*) increased in occurrence from 12% at age 10 to 32% at age 18. Again, age differences were not significant, but the linear trend was.

Comparing the two types of deviancies revealed a significant difference between them, F (1,406) = 11.85, $p < .001$, with *object-subject deletion* being significantly more frequent than *object-object deletion*. There was also a significant interaction with

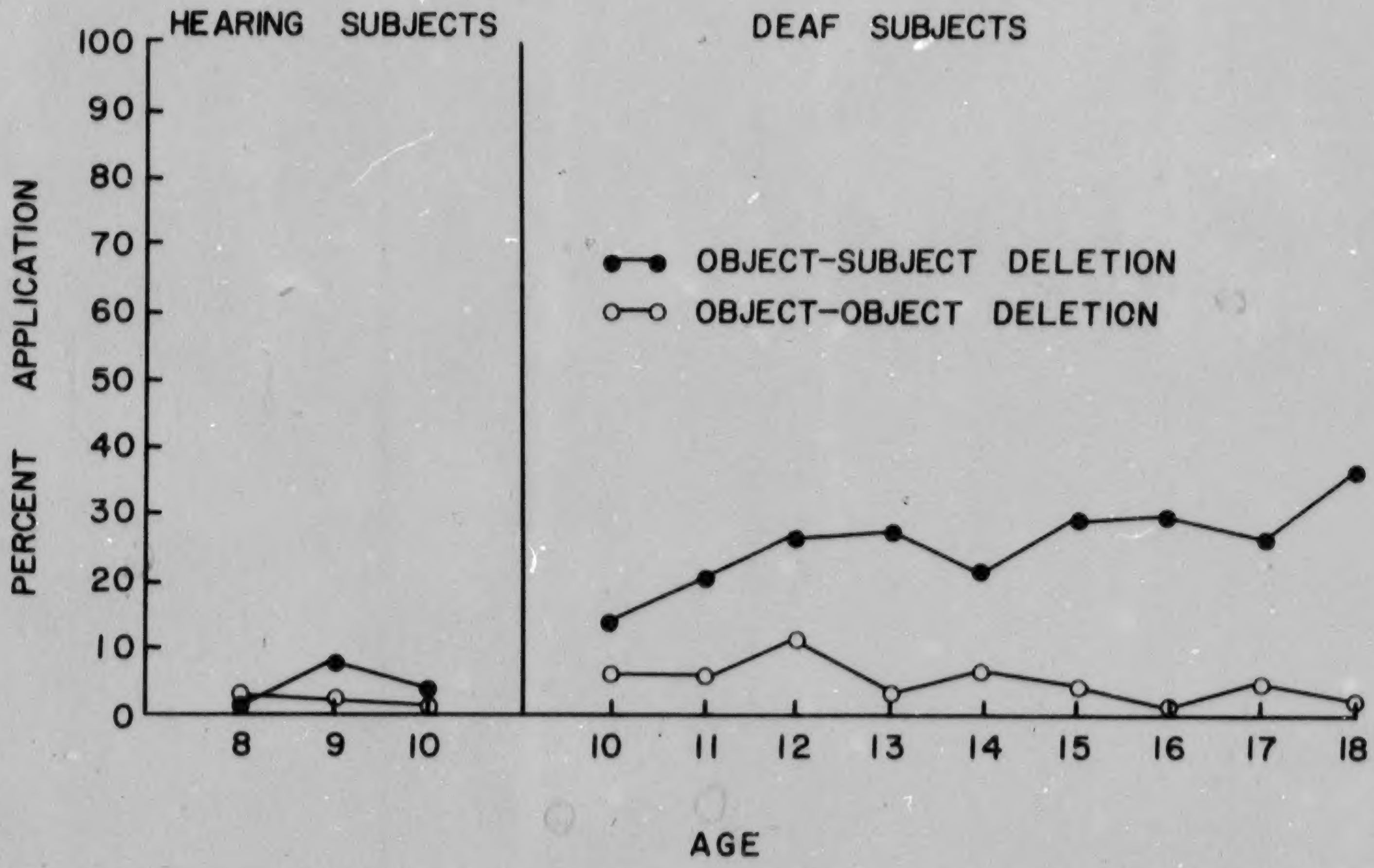


Figure 21. Percent of application of *object-object* deletion and *object-subject* deletion

age, F (8,406) = 2.02, $p < .05$; differences in occurrence of the two types of deviancies increased over age (see Figure 21). Hearing students, in contrast, made almost no errors of deletion of either the object-object or object-subject types (less than 1% at both age 8 and age 10). These types of deviancies seem to be mainly a feature of the written language of deaf children.

Disjunction and Alternation

Production of disjunction, and production and comprehension of alternation, were tested.

Disjunction. To assess disjunction, students were asked to fill in a blank in a disjoined structure with a word other than and. Items included disjoined sentences (e.g., Mary bought a new coat _____ Joan did not; 4 items, r = .945) and disjoined adjectives (e.g., The car was old _____ fast; 4 items, r = .935). But was the target word, but not, while, although, and other appropriate, more syntactically mature words were also accepted. Deaf students' ability to provide an appropriate response in disjoined sentences increased from 26% correct at age 10 to 57% correct at age 18. Appropriate responses with disjoined adjectives increased from only 20% at age 10 to only 42% at age 18.

The differences in percentages of correct responses between disjoined sentences and disjoined adjectives were statistically significant, F (1,457) = 70.15, $p < .001$. So also was the interaction of disjoined sentences and adjectives with age, F (8,457) = 2.01, $p < .05$, due mostly to the more rapid improvement on disjoined sentences than disjoined adjectives. Hearing students were approximately 90% correct in their response for disjoined sentences and 92% correct in their responses for disjoined adjectives.

Alternation--Production. The notion of alternation in noun phrases was tested by a fill-in-the-gap format with subject noun phrases (Either Mary _____ Anne will go to the party) and object noun phrases (My sister will buy either a doll_____ a ball). Deaf students' responses were correct approximately equally often in subject position (2 items, r = .963) and object position (2 items, r = .934). For subject position noun phrases, correct scores ranged from 17% correct at age 10 to 69% correct at age 18. For object position, correct scores ranged from 20% correct at age 10 to 66% correct at age 18. Hearing children were able to use or correctly significantly more frequently in sentences with object noun phrases ($\bar{X} = 93\%$) than with subject noun phrases ($\bar{X} = 84\%$), F (1,56) = 7.90, $p < .01$.

Alternation--Comprehension. Comprehension of the notion of alternation in noun phrases was tested by asking the subjects to write answers to questions of the form How many boys will buy a new coat? (Original stimulus: Bob or John will buy a new coat; 4 items, r = .933). The 10-year-old deaf students were correct 19% of the time and although correct responses increased significantly with age to 43% correct at age 18, this reflects poor comprehension even at the oldest age. Hearing students also had difficulty with this task, with scores ranging from 42% correct at age 8 to 67% at age 10.

Written Language Sample

In the written language sample, conjoined sentences were the most frequent form of conjoined structure produced by both deaf and hearing students. The results are summarized in Table 14.

Table 14

Incidence of conjoined structures in the written language of deaf and hearing subjects

	% of all conjunction		% of children producing structures			
			Deaf		Hearing	
	Deaf	Hearing	Age 10	Age 18	Age 8	Age 10
Conjoined Sentences	31	45	10	84	70	80
Conjoined Verb Phrases	25	30	17	68	35	65
Conjoined Subjects	22	10	48	76	40	40
Conjoined Objects	18	10	27	60	20	20

For deaf students, 31% of all conjunctions were conjoined sentences; at age 10 they were produced by only 10% of the students, while at 18 they were produced by 84% of the students. A full 45% of conjoined structures produced by hearing students were conjoined sentences, with 70% of the 8-year-olds and 80% of the 10-year-olds producing structures of this type.

Conjoined verb phrases accounted for 25% of the occurrences of conjoined structures, and were produced by 17% of the 10-year-old deaf students and 68% of the 18-year-old deaf students, generally at least two per student. Conjoined verb phrases accounted for 30% of the conjoined structures produced by the hearing students, with a steady increase in the number of students using the structure (35% at age 8 and 65% at age 10).

As can be seen in Table 14, the order of difficulty for conjoined sentences and for the three types of conjunction reduced structures are the same for deaf and hearing students; this order parallels the findings of O'Donnell, Griffin, and Norris (1967) with the written language of third, fifth, and seventh-grade hearing children.

Conjoined structures with *but* occurred only 119 times in the 472 writing samples, compared to 2,431 uses of *and*. At age 10, only 4% of the students used *but* in a conjoined structure at least once; the percentage increased gradually to 31% at age 17 and at 18 the figure was 22%. The hearing students produced disjoined structures just 8 times as compared to 219 instances of *and* conjunction. Fifteen percent of the hearing students at ages 8 and 9, but just 5% at age 10, used *but* at least once. Conjunctions with *or* (i.e., alternation) occurred even less frequently, with just 36 uses. Two percent of the deaf students at age 10 (1 student) used such a structure and 10% (5 students) at age 18. For the hearing students, there was only one occurrence, provided by an 8-year-old.

The three "deviant" structures discussed in this chapter were also investigated through the written language samples. *Object-subject deletion* and *object-object deletion* were applied very infrequently, with the former occurring only 14 times and the latter 13 times in the 472 samples. Twenty-two percent of the deaf students produced at least one *object-subject deleted* structure, and the same was true for *object-object deletion*. However, no student applied either *object-subject deletion* or *object-object deletion* more than three times, and most produced only one instance; these students were scattered over all ages. No hearing student applied either *object-subject deletion* or *object-object deletion*.

And-deletion proved to be somewhat more common. *And-deletion* was applied in fully 18% of all possible environments, with 21% of the deaf students at age 10, and 26% at age 18, supplying it at least once. It is also interesting to note that all cases but one involved conjoined verb phrases. Even more interesting, however, was the fact that the hearing students deleted *and* in 11% of the possible cases (all in conjoined verb phrases), with 5% of the hearing students applying this deviant rule at age 8 and 30% at age 9. Hunt (1965) reported 11 occurrences (out of 393 conjoined structures) of various types of *and-deletion* in his fourth grade sample of hearing students, but did not indicate how many students were responsible for these errors. Evidently such deletions do occur to some extent with hearing children.

The order of difficulty of the three deviant structures in written samples parallels that of the TSA results.

Discussion

In general, the results indicated that with increasing age, deaf students were able to make more accurate judgments about grammatical English. By 18 years of age the students were correct in their grammaticality judgments about most conjoined structures 80% of the time or more. From this it can be inferred that the rules of conjunction as they are used to make grammaticality judgments have been reasonably well acquired by deaf students by 18 years of age, although it should be pointed out that at 18 years, deaf subjects were still unable to make these simple grammaticality judgments concerning the use of conjunction about 20% of the time, whereas almost all of the 10-year-old hearing subjects could perform the tasks without error. Production of conjoined structures was somewhat more difficult for the hearing subjects than judging the grammaticality of structures, and much more difficult for the deaf subjects. Disjunction and alternation appeared to be even more difficult than either conjunction or conjunction reduction for deaf students.

Menyuk (1963, 1964) reported that young hearing children in the process of acquiring English produced fully conjoined sentences at an earlier age than they produced conjunction reduced structures, but did not show any differences in production of conjoined noun phrases, adjectives, or verb phrases. In the written language samples in the present study, both deaf and hearing subjects produced conjoined sentences more frequently than any of the three types of conjunction reduced structures, which conforms with Menyuk's findings on early emergence of structures in young hearing children. However, both deaf and hearing subjects also showed differences among the conjunction reduced structures, with conjoined verb phrases being most common for both groups, followed by conjoined subjects and conjoined objects (Table 14). In the production data on the TSA there was a clear pattern of use of conjoined structures. In the environments for conjunction reduction, the immature use of correct, but unreduced, conjoined sentences decreased with age. At the same time, the replacement of unreduced conjoined sentences by conjoined subject noun phrases was easier than the replacement of unreduced conjoined sentences by conjoined object noun phrases, which in turn was easier than the replacement of unreduced conjoined sentences by conjoined verb phrases. In other words, production data on the TSA showed that unreduced conjoined sentences developed earliest and differentiation of conjunction into various types of reduced conjoined structures followed the order: conjoined subjects, conjoined objects, and conjoined verb phrases.

The decreasing acceptability of *and-deletion* with age suggests that deaf students are, in fact, able to reformulate their hypotheses about the nature of English syntax as a result of their exposure to English. This reformulation results in greater rejection of *and-deleted* structures over age. Of the various *and-deleted* structures tested, deaf students had the most difficulty in judging the grammaticality of *and-deleted* verb phrases. The higher acceptance of *and-deletion* in verb phrases could be due to confusion with other verb-verb structures (VV) in English, such as VV with modals, auxiliaries, and particles (*can go*, *start working*), VV with passives (*was pushed* by), and VV in relative clauses (The girl who the boy *pushed* *cried*). The finding that hearing students in the study experienced some difficulty judging the grammaticality of *and-deleted* structures is similar to the findings of Hunt (1965) that *and-deleted* sentences occurred in the free production of hearing students at the fourth grade level. This suggests that assumptions about English which lead to the *and-deletion* rule may be part of the normal developmental sequence.

When presented with the environments for *object-object deletion* and *object-subject deletion*, deaf students produced *object-object deleted* sentences at all ages. Since these deletion environments exist only in cases where sentence conjoining is the correct form of conjunction, one possible explanation is that *object-object* and *object-subject deletion* are the result of an overgeneralization of the conjunction reduction rule to all sentences with common elements. *Object-object deletion* and *object-subject deletion* occur in those environments where English pronominalizes. This suggests that deaf students have incorrectly assumed that because redundancy is reduced in these environments by pronominalization, redundancy can be eliminated altogether by deletion. In many cases in English this is true, but apparently deaf students have not learned to restrict the environment for application of the Standard English deletion rule.

That *object-object deletion* tended to decrease with increasing age suggests that deaf students are still attempting to refine their hypotheses even at the oldest ages tested, but the fact that *object-subject deletion* tended to increase with age requires further explanation. In English it is not possible to delete the *object* of the second sentence in a conjunction sequence and still produce a grammatical sentence. Thus there are no grammatical English sentences which resemble the output of *object-object deletion*. There are, however, environments in which it is possible to delete the *subject* of the second sentence of a conjoined sentence and still produce a grammatical English sentence. These are the sentences which result in a conjoined verb phrase, as in the reduction of *The man washed the car*. *The man cut the* grass to The man washed the car and cut the grass, by deletion of the subject of the second sentence. Of course, in this situation the subject of the second sentence meets the criteria for conjunction reduction and is coreferent to the subject of the first sentence--the applicable rule might be referred to as subject-subject deletion. In object-subject deletion also, the subject of the second sentence is deleted, but the resulting sentence has a meaning different from the original sentence sequence. For example, The boy kicked the cat. The cat ran away reduces by the deviant rule of object-subject deletion to The boy kicked the cat and ran away, which would be derived by the Standard English rule of subject-subject deletion from The boy kicked the cat. The boy ran away. For deaf students with only the object-subject deletion rule, The boy kicked the cat and ran away, could mean only that the boy ran away. For those deaf students with both object-subject deletion and subject-subject deletion, the sentence is ambiguous.

The picture that emerges from this study of conjunction in the language of deaf students is similar to that found in other language structures. Deaf students exhibit an increase in mastery of specific syntactic structures with age, with the rate of improvement being very slow in such processes as relativization and more rapid in other processes such as conjunction. There is a general pattern of great retardation in acquisition of the structures as compared to hearing subjects, but of more interest is the presence of deviant patterns in syntactic structures which appear to be unique to deaf individuals. While some deviant rules, such as and-deletion, were found also in the language of hearing subjects and showed a marked decrease in application in deaf persons with increasing age, other deviant rules, such as object-object deletion and object-subject deletion, rarely occurred in hearing subjects and, in deaf subjects, seemed to be resistant to extinction with age. It is possible, of course, that remediation directed toward such syntactic deviancies would prove successful.

In the Reading for Meaning series (McKee, et al, 1966), which were analyzed, conjoined subjects, objects, and verb phrases were found to appear in the very first primer of the series, while conjoined sentences do not occur until the first grade reader. It is clear that this is exactly reversed from what it should be, since reduced structures appear in the language of deaf students much later than do full conjoined sentences. It is also of interest to note that conjoined verb phrases were used in nine out of every hundred sentences in the first primer, although usage decreased to three uses per hundred sentences in the first grade reader (before again increasing). This is clearly far too many occurrences considering the difficulty deaf students have with conjoined verb phrases, which is the most difficult conjoined structure of all in judging grammaticality and which appears significantly less frequently in the written language than do full conjoined sentences.

CHAPTER 7

COMPLEMENTATION

The third recursive process in English, and the topic of this chapter, is complementation. An example of a sentence with a clausal complement is: John knows *that Mary is my sister*. Here, two simple sentences (*John knows it*. *Mary is my sister*) are joined by the complementizer *that* (hence the name *that*-complement used by transformational grammarians) so as to form a complex sentence. The second sentence (*Mary is my sister*) is embedded in the first (*John knows it*). The appearance of *that* is optional in this case, since *John knows Mary is my sister* is also grammatical.

The traditional infinitive (infinitival complement) is seen in transformational terms as the reduction of a complete sentence which is embedded in another sentence. Infinitival complements are sometimes referred to as *for-to* complements because the full-form complementizer consists of these two morphemes. For example, in *Henry likes for me to play the bongos*, the infinitive is derived from an embedded sentence in the deep conceptual structure (*I play the bongos*) with *for* and *to* inserted. Under certain specified conditions, various elements may (and sometimes must) be deleted: the subject of the complement, *for*, and sometimes *to*. For example, *John wants to go* is derived from a deeper-level structure something like *John wants for John to go* by the deletion of both *for* and *John*, the subject of the complement. In *Horace wants Harriet to wear a kimono*, derived from *Horace wants for Harriet to wear a kimono*, *for* has been deleted, but not the complement subject, *Harriet*. Finally, the sentence *I heard the children sing* derives from *I heard the children for the children to sing*, by deletion of not only *for* and the children, but *to* as well. (*To* is deleted only after verbs of perception such as *see*, *hear*, *watch*, and *smell*).

Gerund formation has also been reanalyzed within the transformational framework. For example, the two simple sentences *John watches TV* and *It annoys me* are considered to underlie the sentence *John's watching TV annoys me*. Consequently this type of complement is referred to as a POSS-*ing* complement, since it contains a possessive morpheme (*'s*) and *ing*. When the person doing the possessing is unknown, the two underlying simple sentences would be written *Someone watches TV* and *It annoys me*, and the complex sentence would be *Watching TV annoys me*. Notice than in such cases the possessive morpheme is deleted from the sentence as spoken (or written), as well as the subject of the complement.

The three types of complements are constrained by the type of main verb in the sentence. Perception verbs may take infinitival complements (with *for-to* deleted) (as in *I watched the teacher sing*) or POSS-*ing* complements (*I watched the teacher singing*), but not *that* complements (I watched *that the teacher sing*). Some active verbs, those which express an active process rather than a passive state, such as: *anger*, *help*, *interest*, can take all three types of complements (*John's leaving* angered me, It angered me *to see him like that*, It angered me *that she was so rude*). Some stative verbs, those which express a passive state rather than an ongoing activity, e.g., *be*, *appear*, *seem*, can also take all three complements (It seemed *to last forever*, It seemed *that it would last forever*, *Eleanor's staying past noon* seemed rude). However, which complements a particular verb can take must apparently be learned for each verb; that is, no simple rules have been found which predict which complements go with which verbs.

A complement can serve as either the subject or the object of the sentence in which it is embedded. For example, in *John's leaving angered me*, *John's leaving*, a POSS-*ing* complement, is the subject of the verb *anger*. In *John knows that Mary is my sister*, *that Mary is my sister* is the object of the verb *know*. Object complements are used more frequently and are subject to fewer constraints on their usage than subject complements.

Related Research

Limber (1973) investigated the development of complex sentences in young hearing children prior to the age of 3. He reported that unmarked and marked infinitival complements and *that*-complements were present at this early age but that no POSS-*ing* complements appeared. He reported also that the first complement-taking verbs were active verbs, followed next by the perception verbs, and that no stative verbs appeared with complements up to the age of 3. Finally, he reported that within a month after a verb capable of taking a complement appeared in the child's speech, that verb was actually found to appear with complements, unless the child was at such an early developmental stage that he was not producing any four word utterances (needed for a simple complement) at all. Chomsky (1969) reported that the children she studied had not mastered certain complement-taking verbs (*ask*, *tell*, *promise*), which have idiosyncratic properties, as late as 9 years of age.

A preliminary analysis of more than 500 written language samples collected by Quigley (1969) from 135 deaf students aged 9 through 19 years revealed that fewer than 10% of the students used any complements at all. Most of those that were used occurred with perception verbs and none were subject complements, although all three types of complements (*for-to*, POSS-*ing*, and *that*) were represented, though obviously in very small numbers. In addition, a variety of seemingly systematic deviations were found which are discussed in greater detail later in this chapter.

Results

The data on complement structures has been drawn from the *Complementation: Infinitives and Gerunds* subtest of the TSA, which tested the children's understanding of infinitival and gerundive complements. Other aspects of complementation had been included in the pilot test battery; however, they were found to be too difficult for even the oldest deaf students tested (19 years of age) and so were eliminated from the final test battery.

The items on the subtest were of the "right-wrong-rewrite" format. Students were asked to make a judgment of grammaticality about each stimulus sentence.

Looking at the *Complementation* subtest as a whole (32 items, $r = .757$) deaf students were able to make judgments of grammaticality with slowly increasing accuracy over age, $F(8,455) = 7.87$, $p < .001$, and $F(1,455) = 55.34$, $p < .001$. Scores ranged from 50% at age 10 to 63% correct at age 18. However, it was not until the students were 16 years of age that their scores departed from the chance level of 50%. Hearing students' scores ranged from 83% correct at age 8 to 88% correct at age 10, but these age differences were not significant.

When items were grouped according to the function of the complement in the sentence, either subject (8 items, $r = .468$) or object (24 items, $r = .735$), no significant differences were found.

Examination was made of the effect of complement type on correct judgments. POSS-*ing* complements (11 items, $r = .577$, $\bar{X} = 59\%$) were significantly easier than *for-to* complements (21 items, $r = .668$, $\bar{X} = 55\%$), $F(1,463) = 15.5$, $p < .001$. For hearing students, POSS-*ing* complements ($\bar{X} = 95\%$) were also significantly easier than *for-to* complements ($\bar{X} = 82\%$).

The type of verb used also had a significant effect on judgments of grammaticality $F(2,926) = 8.4$, $p < .001$. Verbs of perception (e.g., *hear*, 8 items, $r = .412$, $\bar{X} = 60\%$) were easier than stative verbs (e.g, *be*, 8 items, $r = .468$, $\bar{X} = 56\%$) and active verbs (e.g., *go*, 16 items, $r = .710$, $\bar{X} = 55\%$). For hearing students, stative verbs ($\bar{X} = 95\%$) were easier than both verbs of perception ($\bar{X} = 84\%$) and active verbs ($\bar{X} - 82\%$). Conclusions based on these main effects must, however, be tempered by their significant interaction, $F(2,926) = 154.5$, $p < .001$, which can be seen in Figure 22.

An examination of the students' ability to judge correctly sentences which contained errors in the use of the complement revealed signficant differences among the error possibilities,

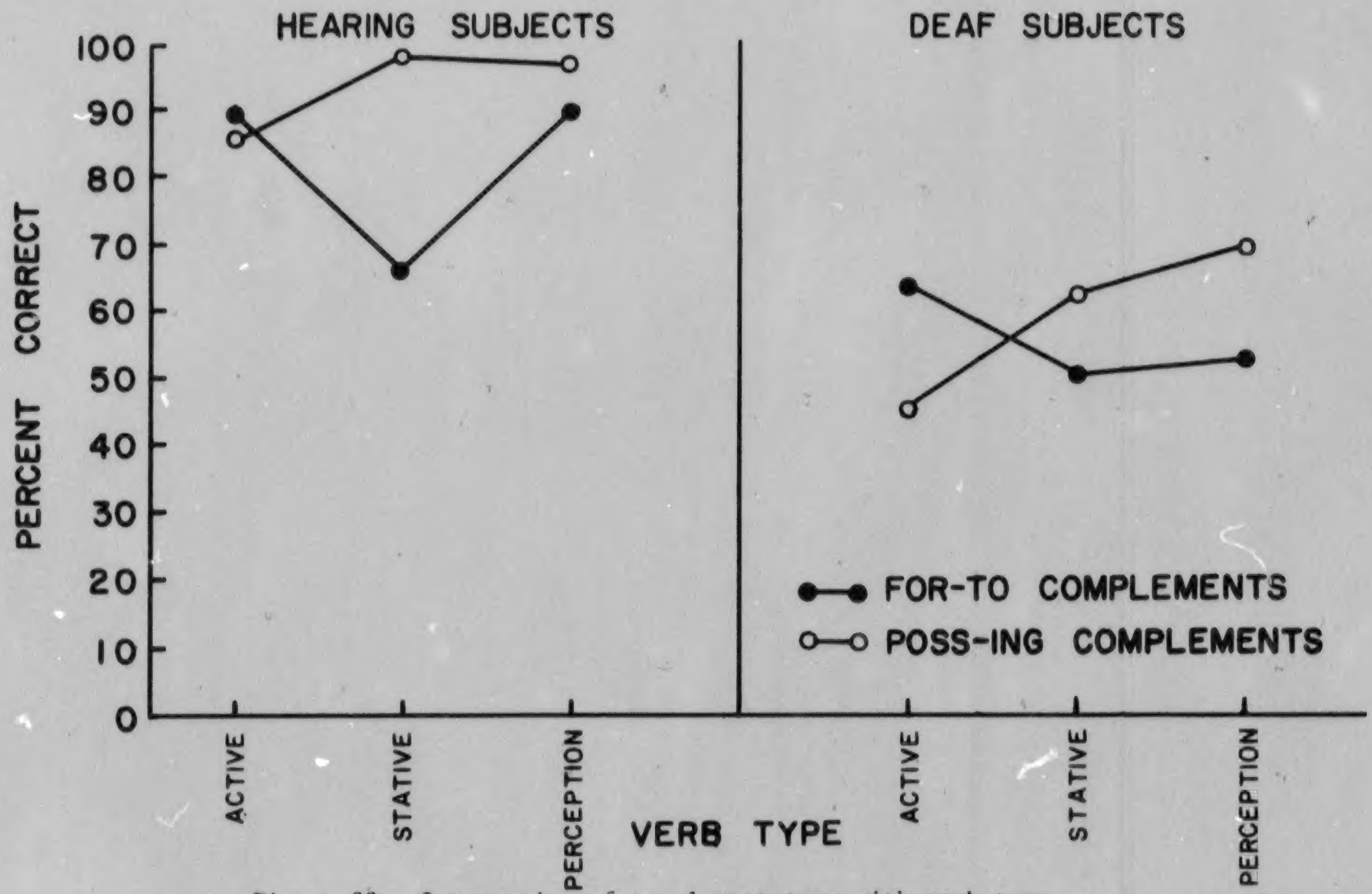


Figure 22. Interaction of complement type with verb type

$\underline{F}$ (5,2314) = 104.3, $\underline{p} < .001$. Students were able to recognize for-to complement sentences in which the for had not properly been deleted, thus with an "extra" for (For to play baseball is fun, 6 items, $\underline{r} = .782$) as incorrect 58% of the time. In contrast, when an extra to had been inserted into a POSS-ing complementizer (John goes to fishing, 5 items, $\underline{r} = .785$) students correctly judged the sentence as ungrammatical only 39% of the time. When an infinitival complement was incorrectly used in place of a gerund (John goes to fish, 6 items, $\underline{r} = .331$), or when an infinitive was incorrectly inflected (Bill liked to played baseball, 3 items, $\underline{r} = .720$), the students' performance was at chance, $\overline{X}$ = 50% to 51%. The grammatical items were correctly judged as such with 70% accuracy, and this level of accuracy was maintained across all nine groups.

These error types interacted significantly with age, $\underline{F}$ (40,2315) = 5.9, $\underline{p} < .001$. As can be seen in Figure 23, students' ability to recognize as incorrect those complementizers with an extra for improved steadily from 37% correct at age 10 to 79% correct at age 18. For POSS-ing complementizers with an extra to, there was a quadratic trend, decreasing at ages 11 and 12 before finally reaching 57% correct at age 18. On the sentences where an infinitival was used in place of a gerundive complement the students' performance hovered around chance (50%) across all ages, perhaps because grammaticality of this sentence form is marginal even in Standard English. Inflected infinitives were recognized as incorrect with increasing accuracy over age (from 37% at age 10 to 77% at age 18).

For the hearing students, judgments of sentences in which an infinitival complement was used in place of a gerundive complement were correct 79% of the time. Extra to in POSS-ing complements was recognized as wrong 85% of the time, and extra for in for-to complements was recognized as wrong 88% of the time. Inflected infinitives were judged incorrect 86% of the time, while correct sentences were identified as correct 97% of the time. There was no significant age effect for the hearing students.

Written Language Sample

Analysis of the deaf students' written language samples revealed a general increase of complement usage over age. No subject complements were produced by any of the deaf students, although at least one object complement was used by 22% of the deaf students at age 10, increasing to 92% of the deaf students at age 18. For-to complements were used most frequently, followed by that-complements, with only a few POSS-ing complements. Nearly all of the complements occurred with active verbs, fewer than 1% occurred with perception verbs, and none occurred with stative verbs. Fewer than 10% of the infinitive complements were

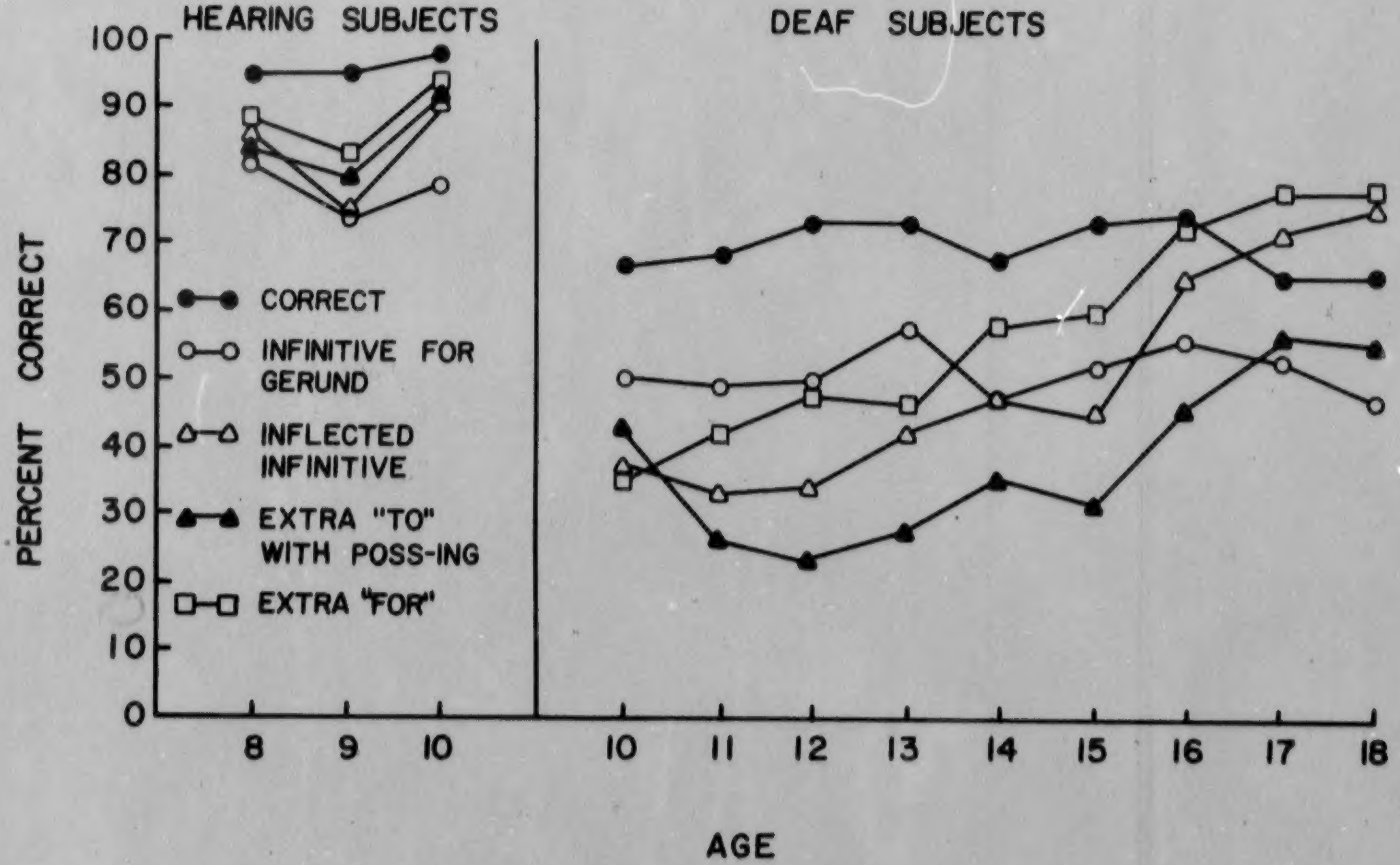


Figure 23. Interaction of age with error type

incorrectly inflected. However, an error type not included in the test battery was quite common. In erroneous sentences of this type, the unmarked infinitive (without to) was used, (I wanted Bill go) possibly because of confusion with the acceptable form with perception verbs, (I saw Bill go). This error occurred in 36% of the infinitival complements at age 10, decreasing to 8% of the infinitives at age 18.

Thirty-five percent of the hearing students used at least one object complement, but as with the deaf subjects, no hearing students used any subject complement. Also similar to the deaf students was a more frequent use of for-to complements in comparison to that complements or POSS-ing complements, which occurred approximately an equal number of times. Finally, all complements used by the hearing students occurred with active verbs, again paralleling the situation with the deaf students. Hearing students produced none of the deviant structures tested in the TSA, including incorrectly inflected infinitives. The linear age trend was not significant for the complement categories measured for the hearing sample.

Discussion

Of the three recursive processes in English, the TSA has shown complementation to be the most difficult. This difficulty is reflected in the chance level of performance of all but the oldest deaf students and in the fact that pilot testing revealed that even 19-year-old deaf subjects did not attempt many complementation tasks. Comparison of deaf students' performance on the other two recursive processes, relativization (chapter 5) and conjunction (chapter 6) revealed that relativization was much more difficult than conjunction. The deaf students performed well above the chance level on both relativization and conjunction, and their errors appeared to be the result of classifiable, incorrect strategies. The near-chance level of performance on complementation suggests that students do not have a sufficient understanding of complementation to make consistent grammaticality judgments.

The results indicated that there were no differences in deaf students' ability to judge the grammaticality of subject or object complements. For both types of complements, performance was at the chance level until approximately age 16. However, analysis of the written language samples revealed that at least one-fourth of the younger deaf students (10 - 12 year olds) used some object complements. The students tested had clearly been exposed to complements, either formally or informally through their reading. Certain basic concepts (e.g., John wants to go) can be expressed efficiently and clearly only through the use of complements and many students attempted to use them while having only a minimal understanding of their structure (as evidenced by the many errors in agreement, etc.). Since subject complements (e.g., To fish is fun) are not commonly used in any but the most formal Standard English and the students would not be widely exposed to them, it follows that the written language samples contained predominantly attempts to use object complements. However, it appeared that while students attempted to use some complements in their writing, when required to make judgments of the grammaticality of a specific complement structure the students were mostly unsuccessful. The difficulty of making grammaticality judgments may be so great that despite their attempted use of object complements, deaf students up to the age of 16 years were unable to discriminate between correct and incorrect forms and as a consequence were forced to guess, thus producing the chance level of performance.

The results for deaf students showed that for-to complements were judged correctly more frequently than POSS-ing complements for active verbs, but for stative verbs and verbs of perception POSS-ing was judged correctly more frequently than for-to. Moreover, in the written language samples, for-to complements were produced considerably more often than that complements or POSS-ing complements, suggesting that, since most of the sentences produced in the written language had complements occurring with active verbs, and since judgments of POSS-ing witn active verbs were at the chance level, deaf students find both the comprehension and production of for-to complement to be less difficult than other types. Additionally, few complements occurred with verbs of perception, and none with stative verbs, suggesting that these forms were not very familiar to the students.

Although the deaf students' ability to judge correct stimulus sentences accurately did not change over age, their actual use of complement structures in the written language did increase with age, which suggested that they were unable to recognize a correct complement when they saw one, and that the increase in usage of complements unaccompanied by an increased ability to recognize them may be attributable to the difficulty of judging grammaticality in the early stages of learning a structure. Results for the erroneous patterns revealed that although students improved with age in their ability to correctly judge sentences with inflected infinitives as ungrammatical, their use of inflected infinitives in production remained fairly constant over age, indicating again that their production here may not yet be a reflection of internalized generative rules. Students' correct judgments of complements with an extra to (e.g., John goes to fishing) were below the chance level. One possible explanation for this might be that in some of the items with extra to, the students might have interpreted the to as a preposition rather than a complement, predisposing them to judge it as grammatical.

None of the error possibilities infinitives for gerunds, extra to, or extra for measured in the TSA occurred in the written language samples.

In all cases the performance of the deaf students was far below that of the hearing students, but relative difficulty was similar for the two groups, with POSS-ing complements being more difficult than for-to complements, and with both groups producing more object complements than subject complements. Hearing students as well as deaf students had some difficulties with deviant complement structures of all types, but to a much lesser degree. The only deviant rule which appears to be used by deaf students but not by hearing students is the incorrect inflection of infinitives. Ten percent were incorrect for the deaf children, but none for the hearing.

Analysis of the Reading for Meaning series (McKee, et al, 1966) showed an increase in the use of for-to and POSS-ing complement structures from approximately four per hundred sentences in the second primer to approximately 32 per hundred sentences in the sixth grade reader. Breaking the complements down by type, there were more than four times as many for-to complements as POSS-ing, and the number of appearances increased steadily from the primer to the sixth grade. POSS-ing complements made ther appearance at the second grade level and increased steadily. Noun complements (those which function as nouns) did not occur until the fourth grade reader, but occurred 21 times (or more) per hundred sentences in the fourth, fifth and sixth grade readers. A comparison with our results makes it clear that there is a large gap between deaf students' ability to handle complements and the syntactic structures they are expected to be able to read in the readers.

CHAPTER 8

PRONOMINALIZATION

Pronominalization is the replacement of a fully specified noun phrase by a pronoun which agrees with the referent (the noun phrase to which it refers) in case, number, person, and, for the third person, gender as well. It is a means of reducing redundancy by eliminating features of the noun phrase which the speaker has already transmitted to the listener. For example, Henry is a fully specified noun phrase which contains the same information as the pronoun he but which, in addition, includes extra information specifying which he. Proper usage of pronominalization rules requires correct matching of semantic features and the ability to recognize correct syntactic environments. There are four main requirements which must be satisfied in English before a pronoun is said to be appropriate. They are: a) case (subject, object, possessive adjective, possessive pronoun or reflexive), b) number (singular or plural), c) person (first, second, or third), and d) gender in the third person singular (masculine, feminine, or neuter).

There are two syntactic environments in which pronominalization is obligatory. The first of these is relative clauses, where a noun phrase in the clause is obligatorily replaced by a relative pronoun. In English, it is not correct to say The boy the boy hit the girl ran away; the second occurrence of the boy must be replaced by a relative pronoun, who or that, to give The boy who hit the girl ran away. The second obligatory environment is reflexives. Within a simple single sentence, the form John hurt John, where John refers to the same person in both instances, is not acceptable. The second occurrence of John must be replaced by himself, a reflexive pronoun which agrees in person and gender with John.

There are also environments in English where pronominalization is the preferred and probably most frequent form, although failure to pronominalize is also acceptable. Such cases arise when the noun phrase in question is in close proximity to a previous occurrence of that same noun phrase, as the second occurrence of John in John bought that record for me but Mary paid John for it. Generally in conjoined sentences, or in sentences where the antecedent of the pronoun is in the immediately preceding sentence, there is little chance of a pronominalized form being misinterpreted and consequently pronominalization is regularly but not necessarily used.

Lastly, there are environments in English where pronominalization is totally optional. This is usually when the antecedent is sufficiently far away from the noun phrase in question that one may repeat the noun phrase without giving a feeling of stilted redundancy, but at the same time, the antecedent is sufficiently close that pronominalizing would not result in ambiguous reference. Appropriate use of pronominalization in these environments may be considered to reflect maturity of syntactic style. This investigation has looked at this type of pronominalization as an indicator of syntactic maturity.

Related Research

Research on the acquisition of pronominalization by children includes both semantic and syntactic aspects. Waryas (1973) has delineated several criteria which the child must master in learning the pronoun system: what pronouns mean, when they are used, and which pronoun to use. The data from Huxley (1970), as interpreted by Waryas, indicate that children tend to acquire the semantic features in a hierarchy. The distinction speaker/listener (first person/second person) is acquired reasonably early. Pronouns without gender (*I*, *it*) are acquired before those with gender (*he*, *her*). Singular pronouns are generally acquired before plural. And finally, the more complex case relationships, such as the reflexive, are acquired later, as they require syntactic information for a correct choice to be made.

Hatch (1969) investigated the acceptability of wrong case pronouns in subject and object position by counting the number of sentences changed in an imitation task (for example, *The mouse liked I* changed to *The mouse liked me*). She reported that object case pronouns (*me*, *him*, *them*) incorrectly appearing in subject position are more acceptable (less likely to be changed) than subject pronouns (*I*, *he*, *they*) in object position, suggesting that the subject-object distinction is acquired early.

While Menyuk (1963) did not specifically investigate pronominalization, she did include various aspects of it in her study of the emergence of syntactic structures in children's language. She reported that the general ability to use pronominalization was established in only one-third of the nursery school subjects and slightly more than half of the first grade subjects.

Chomsky (1969) investigated the effects of syntactic environment on the interpretation of pronouns. She studied pronoun reference in forwards and backwards pronominalization environments as interpreted by children aged five to ten years. She reported that the ability to correctly determine the reference of the pronoun was established during the child's fifth year.

Results

The focus of the research reported here is on deaf students' knowledge of the semantic and syntactic features involved in pronoun replacement, first with general pronouns and then with relative pronouns, and on their knowledge of the correct syntactic environments in which pronoun replacement can take place. Data on pronominalization has been drawn from the six subtests of the TSA which examined various aspects of pronoun use. The subtests were: Personal Pronouns (pronominalization of the second identical occurrence of a noun phrase and correct marking of pronouns occurring in subject and object positions), Backwards Pronominalization (where the first, rather than the second, of two coreferent noun phrases is pronominalized), Possessive Adjectives, Possessive Pronouns, Reflexivization, and Relative Pronoun Reference. All of these subtests were of the multiple choice format which required the subject to select an answer from a list of possible answers and to write it in the space provided within the stimulus sentence. Multivariate analysis of variance (Bock, 1966) was used to determine the significance levels of age differences for each of the pronominalization subtests. As Table 15 indicates, all of the subtests showed significant linear increases with increasing age. Additional data on pronominalization were derived from the written compositions which students were asked to produce.

Personal Pronouns

The Backwards Pronominalization subtest measured the effects of backwards pronominalization environments (From where he sat, the boy could see the car) on appropriate choice of personal pronouns. This environmental effect was found to be nonsignificant and for purposes of the analysis the subtest items were included with those of the Personal Pronoun subtest to make up the subject and object cases and were included with the Possessive Adjective subtest, the Possessive Pronoun subtest, and the Reflexives subtest for the analysis of case. Table 16 gives the personal pronouns included in the entire analysis. In order to examine the effects of case, number, and persons across all age groups, a univariate analysis of variance was performed (see Table 17). Since the second person you does not vary in form for the singular and plural, it was not included in this analysis (see Table 18 for second person scores which were not included in the analysis of variance). As can be seen in Table 19, deaf students' ability to correctly select the correct pronoun increased with increasing age for each pronoun tested. In general, the hearing students also followed the pattern of improved performance with age.

Table 15

Age Means, Reliabilities, and Significance Levels for
All Subjects on the Six Pronominalization Subtests

	Percent correct for each age												
	Hearing students			Deaf students									Reliability
Test	8	9	10	10	11	12	13	14	15	16	17	18	KR 20
Backwards pronominalization	92	89	95	49	58	61	69	73	67	83	87	85	.818
Personal pronouns	73	79	83	51	60	60	64	76	73	86	88	88	.920
Possessive adjectives	99	95	98	42	52	54	58	71	63	86	82	82	.859
Possessive pronouns	99	98	98	34	33	39	41	51	50	60	57	64	.876
Reflexives	73	62	87	21	31	38	43	52	51	68	71	73	.962
Relative pronoun reference	77	71	88	27	33	35	36	41	41	52	56	56	.741

	Deaf students			
	Age		Linear trend	
	F	df	F	df
Backwards Pronominalization	13.56	8,457**	98.99	1,457**
Personal pronouns	20.35	8,448**	153.64	1,448**
Possessive adjectives	20.64	8,451**	146.58	1,451**
Possessive pronouns	6.71	8,452**	50.70	1,452**
Reflexive	22.49	8,452**	174.42	1,452**
Relative pronoun reference	14.91	8,452**	112.28	1,452**

** $p < .001$

Table 16

Pronouns Used in the Pronominalization Subtests

	Singular					Plural				
Case	Subject	Object	Possessive Adjective	Possessive Pronoun	Reflexive	Subject	Object	Possessive Adjective	Possessive Pronoun	Reflexive
First person	I	me	my	mine	myself	we	us	our	ours	ourselves
Second person	you	you	your	yours	yourself	you	you	your	yours	yourselves
Third person						they	them	their	theirs	themselves
Masculine	he	him	his	his	himself					
Feminine	she	her	her	hers	herself					
Neuter	it		its		itself					

Table 17

Analysis of Variance Summary Table

	Deaf students				Hearing students			
Source	df	MS	*F*	*p*	df	MS	*F*	*p*
Between *Ss*								
Age	8	24.961	24.832	**	2	.571	5.612	*
Error	434	.764			57	.102		
Within *Ss*								
Case	4	18.928	140.918	**	4	1.997	40.570	**
Age X Case	32	.358	2.664	**	8	.267	5.416	**
Error	1736	.134			228	.050		
Person	1	27.092	298.598	**	1	6.887	147.677	**
Age X Person	8	.366	4.033	**	2	.143	3.065	*
Error	434	.091			57	.047		
Number	1	46.541	466.257	**	1	.687	23.247	**
Age X Number	8	.144	1.441		2	.171	5.788	*
Error	434	.100			57	.030		
Case X Person	4	.419	6.845	**	4	1.325	40.789	**
Age X Case X Person	32	.091	1.482	*	8	.019	.581	
Error	1736	.061			228	.032		
Case X Number	4	1.149	16.287	**	4	.304	11.653	**
Age X Case X Number	32	.118	1.672	*	8	.060	2.302	*
Error	1736	.071			228	.026		
Person X Number	1	.327	6.231	*	1	.321	13.362	**
Age X Person X Number	8	.116	2.204	*	2	.006	.230	
Error	434	.053			57	.024		
Case X Person X Number	4	2.513	42.095	**	4	.081	4.352	*
Age X Case X Person X Number	32	.076	1.279		8	.009	.481	
Error	1736	.060			228	.019		

** $p < .001$
* $p < .05$

Table 18

Mean Percent Correct Scores by Age for Second Person Pronouns

		Hearing students			Deaf students								
		Age			Age								
Case	Pronoun	8	9	10	10	11	12	13	14	15	16	17	18
		(20)[a]	(20)	(20)	(47)	(50)	(53)	(50)	(49)	(50)	(47)	(50)	(47)
Possessive Adjective	your	100	93	100	54	55	63	63	72	69	88	84	87
Possessive Pronoun	yours	100	98	100	27	21	25	28	40	41	56	54	54
Reflexive	yourself, yourselves	63	77	81	17	24	31	34	41	36	52	55	55

[a] Numbers in parentheses indicate the number of children who completed the test.

Table 19

Mean Percent Correct Scores by Age for Each Pronoun in the Case × Person × Number Analysis

				Hearing students			Deaf students								
				Age			Age								
Case	Person	Number	Pronoun	8	9	10	10	11	12	13	14	15	16	17	18
				(20)[a]	(20)	(20)	(47)	(50)	(53)	(50)	(49)	(50)	(47)	(50)	(47)
Subject	First	Singular	I	93	98	96	66	62	72	69	80	77	89	91	91
		Plural	we	93	100	100	81	82	76	71	74	75	81	80	83
	Third	Singular	he,she,it	61	70	80	51	64	58	67	85	73	91	92	90
		Plural	they	60	70	80	45	38	45	46	50	59	77	74	71
Object	First	Singular	me	95	98	100	66	77	74	81	92	90	98	98	94
		Plural	us	98	98	100	59	69	65	68	79	80	93	95	91
	Third	Singular	him,her,it	66	71	76	49	67	63	70	81	79	88	94	91
		Plural	them	56	59	64	31	32	44	44	63	65	78	76	84
Possessive Adjective	First	Singular	my	100	98	95	47	62	63	62	79	68	93	88	89
		Plural	our	98	88	98	33	50	49	57	65	56	87	72	79
	Third	Singular	his,her, its	99	98	98	44	52	57	60	73	66	87	87	82
		Plural	their	98	90	98	24	37	35	39	59	53	72	72	76
Possessive Pronoun	First	Singular	mine	100	100	95	54	52	56	62	76	71	80	79	86
		Plural	ours	100	100	100	37	35	42	46	40	40	52	52	53
	Third	Singular	his,hers, its	100	96	98	31	30	42	40	49	51	60	57	64
		Plural	theirs	95	95	100	24	31	37	35	45	46	54	49	61
Reflexive	First	Singular	myself	93	83	95	39	37	62	70	67	78	86	93	88
		Plural	ourselves	89	62	93	18	30	37	38	47	48	69	70	88
	Third	Singular	himself, herself, itself	80	79	90	26	40	48	57	63	63	81	85	83
		Plural	themselves	55	38	81	17	18	26	30	42	39	57	58	66

[a] Numbers in parentheses indicate the number of children who completed the test.

When items were grouped according to case, there was a significant main effect of case with age which can be seen in Figure 24. Pronouns in subject and object case were approximately equal in difficulty, and were less difficult than possessive adjectives. Possessive pronouns and reflexives were the most difficult. For hearing students, subject and object pronouns were equally difficult, but both were more difficult than possessive adjectives or possessive pronouns, which were also approximately equal in difficulty. Reflexives were more difficult than any other category.

Grouping the subtest items by number revealed that singular pronouns were less difficult than plural pronouns across all ages and cases for the deaf students. For hearing students the pattern of results was the same as that of the deaf students: singular pronouns were significantly less difficult than plural pronouns.

Analysis of the subtest items by person indicated that the first person was significantly easier than the third person for the deaf students. A separate analysis revealed that second person was the most difficult. All three persons showed a steady increase in correct usage with age (see Figure 25) and the interaction of person with age was significant. For hearing students, there was a partial reversal of the order of difficulty. First person was still the least difficult, but second person was less difficult than third person.

These main effects for pronominalization are qualified by the interactions among the various elements tested. These are displayed in Figures 26, 27, 28, and 29.

Relative Pronoun Reference

Selection of the appropriate relative pronoun was the most difficult of any of the pronoun tasks. Subjects were asked to select a relative pronoun from a list of distractors (who, which, what, that, when, where, whose) and put it in a slot beside its correct referent (I saw the boy _____ went home). Deaf students' choices of relative pronouns ranged from 27% correct at age 10 to 56% correct at age 18. Hearing students' scores ranged from 77% correct to 88% correct.

In contrast to the results of the overall analysis of case which indicated that subject and object personal pronouns were about equal in difficulty, a comparison of subject and object use of relative pronouns indicated that subject relative pronouns were significantly easier than object relative pronouns, $F(1,452) = 139.90$, $p < .001$. The interaction with age was also

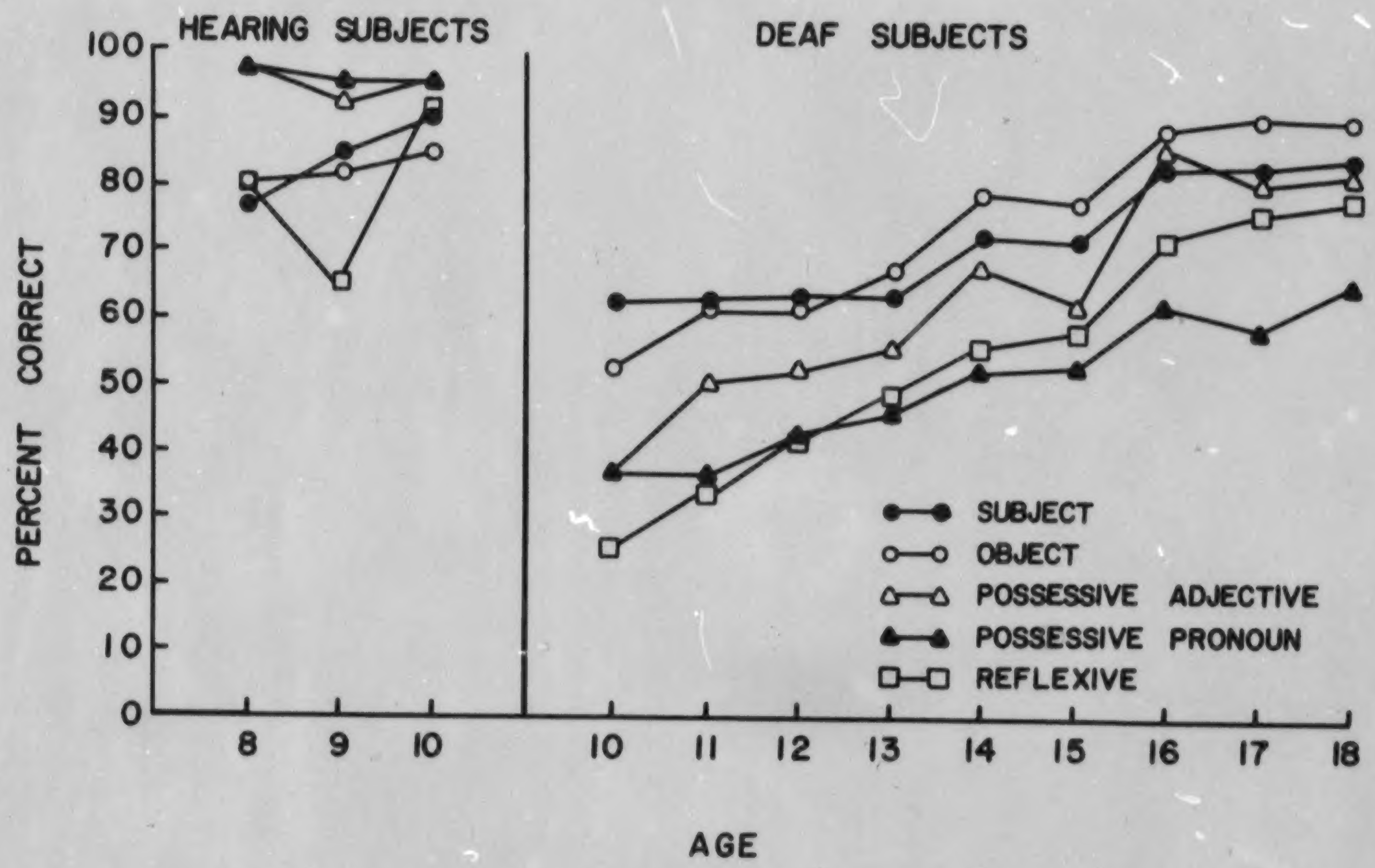


Figure 24. Correct use of pronoun cases over age

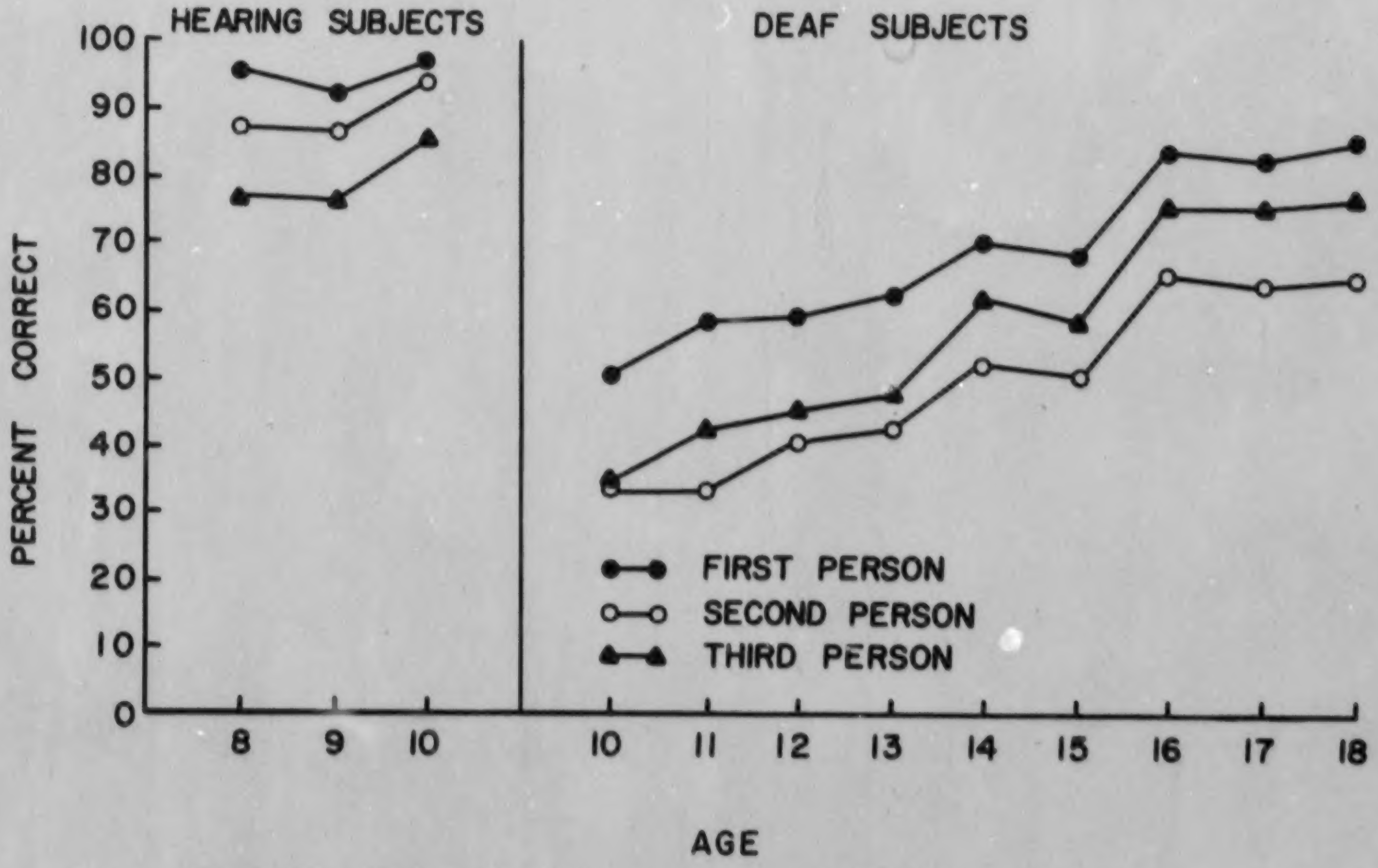


Figure 25. Correct use of first, second, and third person over age

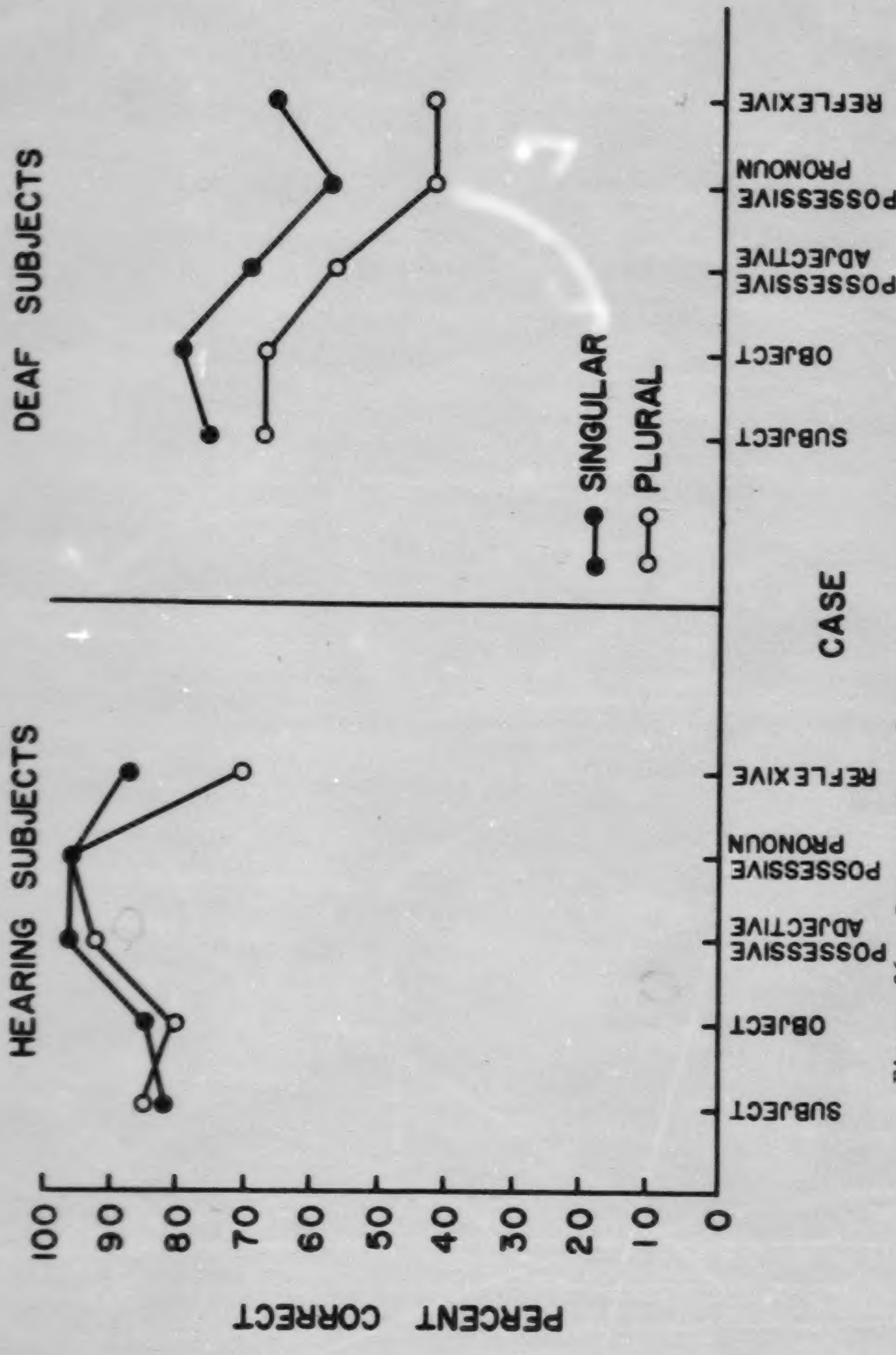


Figure 26. Interaction of pronoun case with number

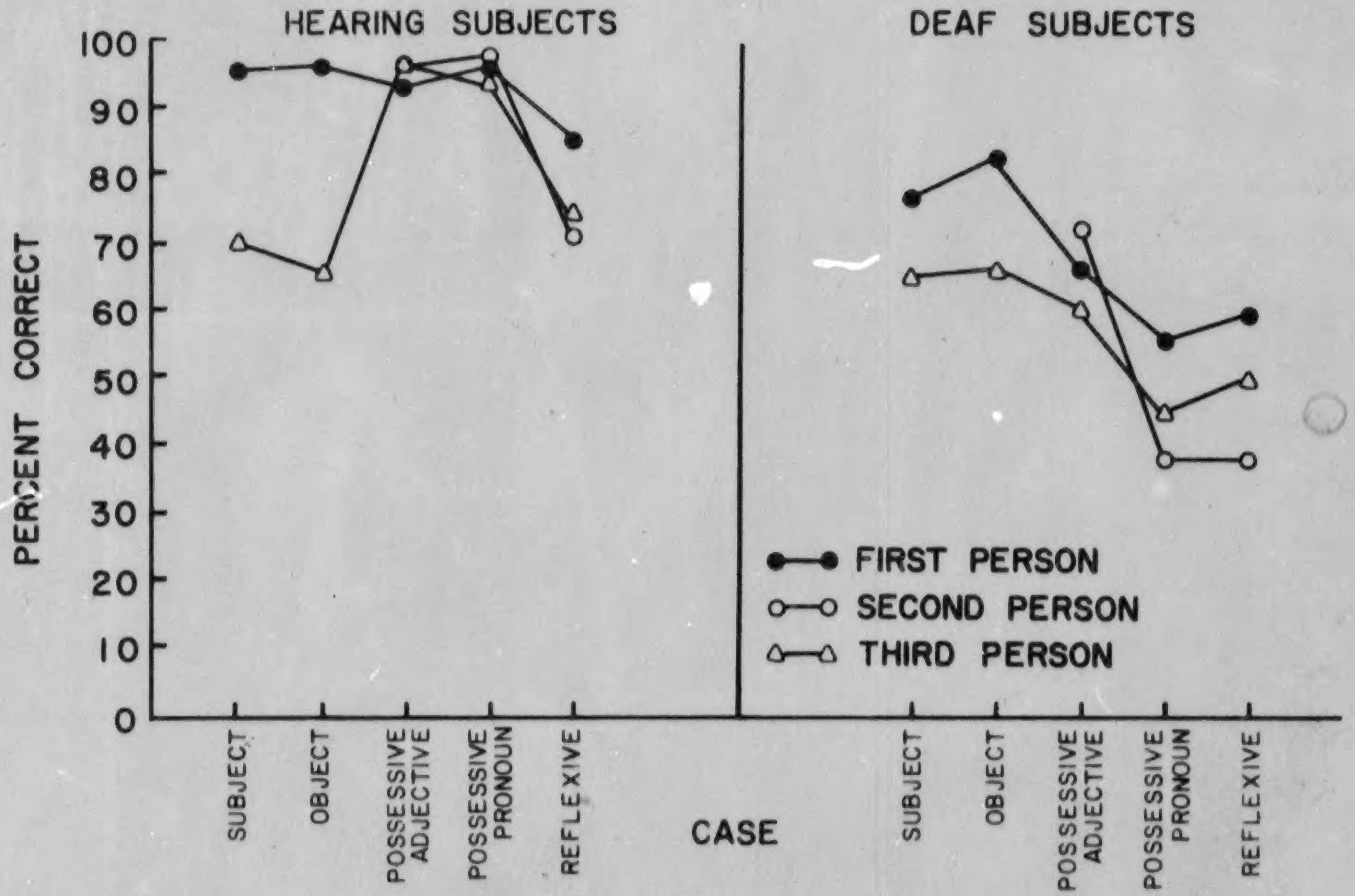


Figure 27. Interaction of pronoun case with person

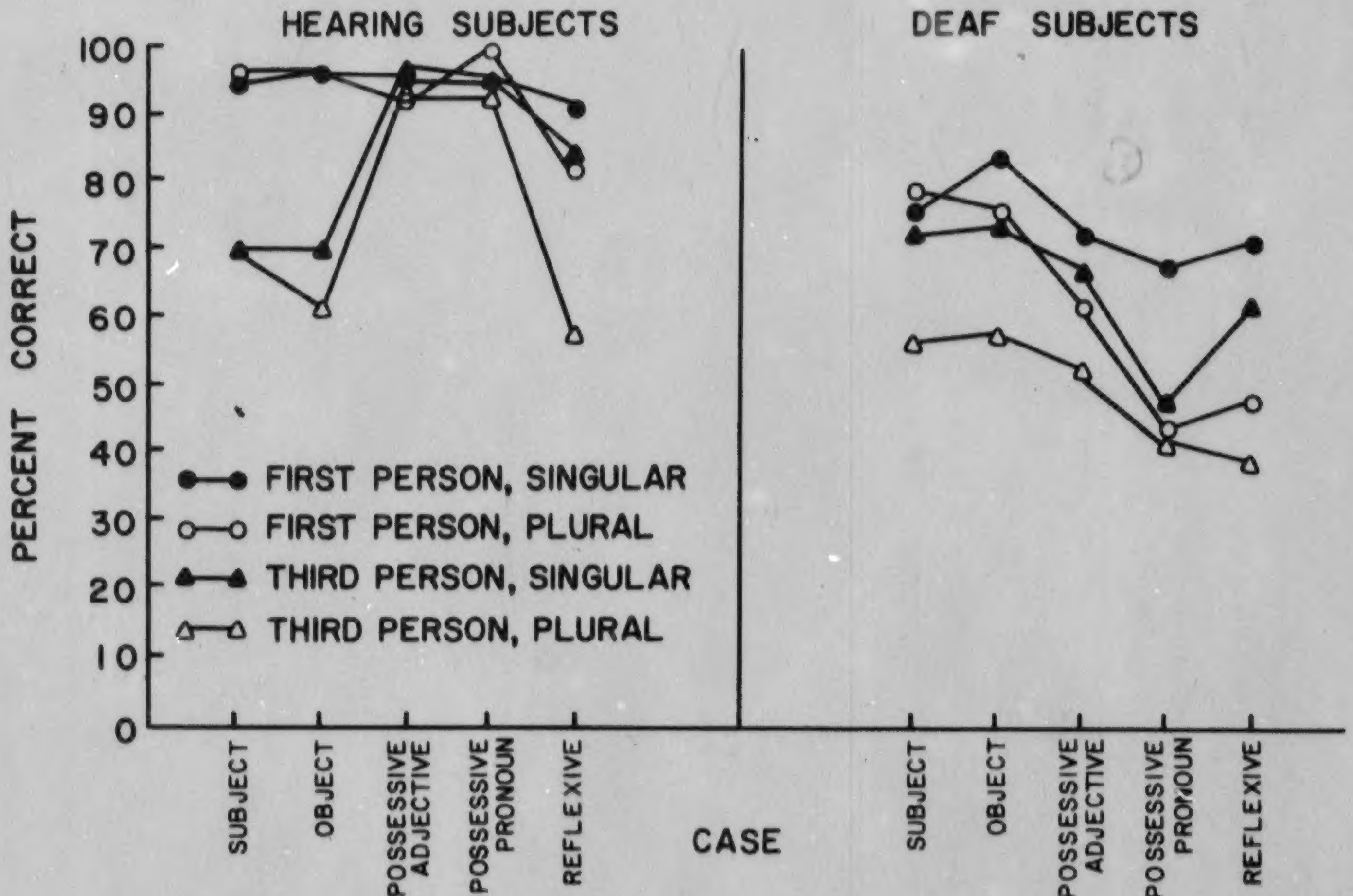


Figure 28. Interaction of pronoun case with person and number

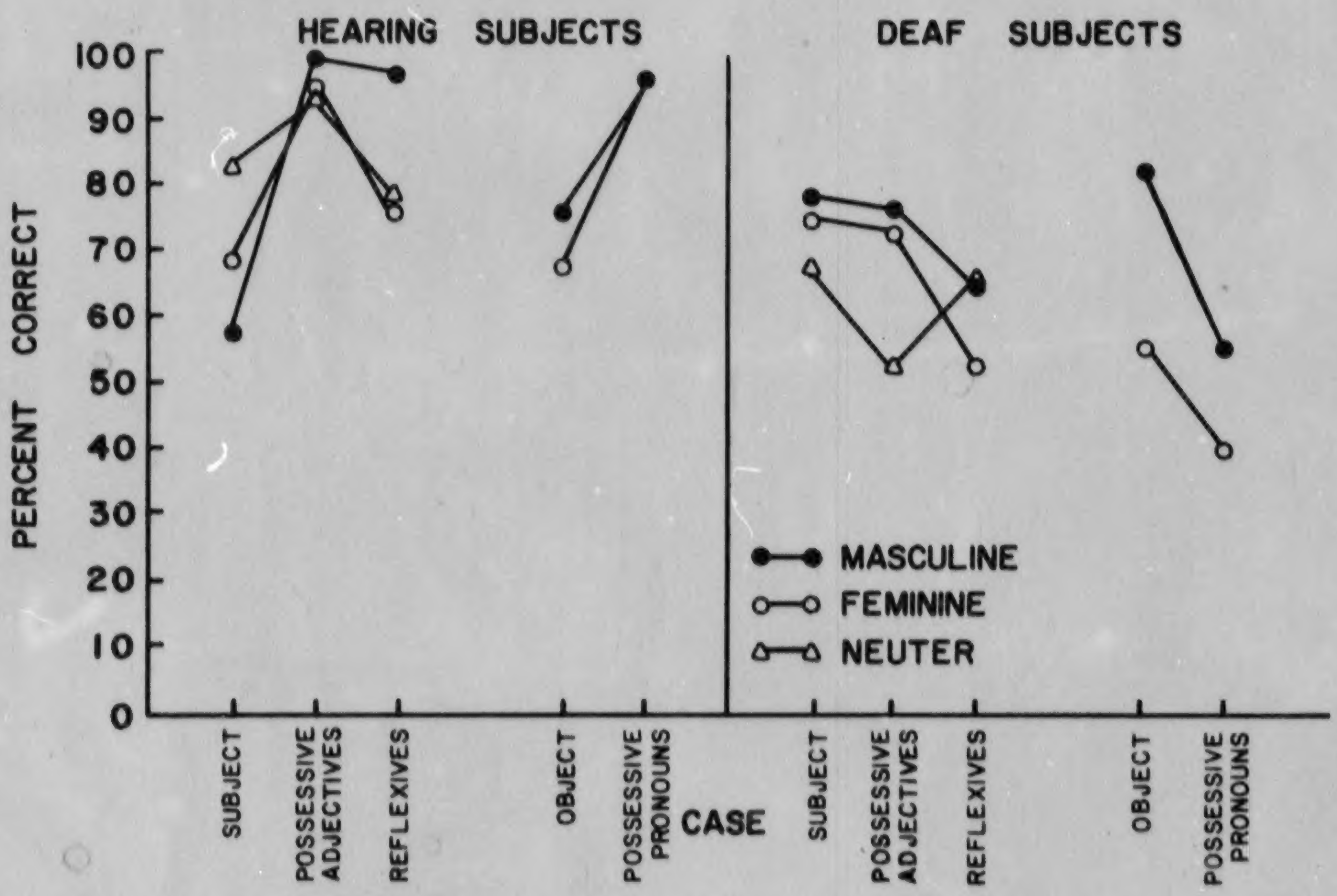


Figure 29. Interaction of pronoun case with gender in third person singular

significant, $F\ (8,452) = 2.86$, $p < .005$, as a result of correct use of subject relative pronouns. Hearing students also found subject relatives less difficult than object relatives, $F\ (1,57) = 16.12$, $p < .001$; the interaction with age was not significant for the hearing students, however.

Relative pronouns also vary depending on whether their referent is human (*who* or *that*) or nonhuman (*which* or *that*). Human relative pronouns were significantly less difficult than nonhuman relative pronouns, $F\ (1,452) = 313.37$, $p < .001$. The interaction of the human-nonhuman distinction with that of subject-object was also significant, $F\ (1,452) = 74.05$, $p < .001$ (see Table 20). When the referent was human, subject relative pronouns were much easier than object relative pronouns. Relative pronouns with a nonhuman referent were more difficult, with subject relatives less difficult than object relatives.

For the hearing students, the difference between human relative pronouns and nonhuman relative pronouns was not significant. However, the interaction between subject-object relative pronouns and human-nonhuman relative pronouns was significant, $F\ (1,57) = 8.81$, $p < .01$. This interaction was due primarily to the relative difficulty of human object relative pronouns compared to the other pairings (human subject, nonhuman subject, and nonhuman object).

Within the current framework of transformational theory, *wh*-words which designate temporal sequences *when*, location *where*, and possession *whose* are considered by some to be related to relative pronouns. Table 20 gives the percentage of correct choices of each of these relative pronoun types for both deaf and hearing students.

Written Language Sample

Analysis of errors in the written compositions provided supplementary data on the students' actual use of the proper pronoun forms in their own writing. There were almost no instances of inappropriate case usage in the written samples. The absence of large numbers of such mistakes adds support to the finding of comparatively good performance of the deaf students on the pronominalization tests. Number mistakes were even less frequent, with no mistakes at all at ages 10, 11, or 12, and a high of only .2% at age 14. In comparison, person mistakes (The family went on a picnic. They packed *our* lunch, rather than They packed *their* lunch) were more frequent, occurring approximately 5% of the time. This percentage of errors indicates uncertainty on the part of deaf students as to the appropriate reference of the different person pronouns.

Table 20

Percent Correct Scores for Different Types of Relative Pronouns

	Hearing subjects			Deaf subjects								
	Age			Age								
	8	9	10	10	11	12	13	14	15	16	17	18
Subject-human	90	90	95	65	79	73	76	80	75	88	88	87
Subject-nonhuman	93	78	93	23	26	28	41	36	30	53	60	55
Object-human	65	63	85	46	50	55	49	47	50	48	48	58
Object-nonhuman	85	78	93	24	29	30	25	31	35	43	43	47
Temporal-initial	75	70	98	15	27	28	32	48	40	60	72	67
Temporal-final	65	65	80	14	24	33	24	36	36	53	48	44
Locative	80	68	68	26	21	22	25	31	29	40	42	42
Possessive	55	55	90	15	16	23	21	29	30	46	56	50

In their written language samples, the hearing students had a total of one case error and one number error in 567 occurrences of pronouns. There were, however, several person errors, indicating that difficulty with person reference is not confined to deaf students.

The analysis of the written language sample also provided information on deaf students' knowledge of the appropriate application of the pronominalization rules, which can be used as an indicator of syntactic maturity. Two environments were analyzed: pronominalization when the antecedent was in the same sentence (relatively obligatory), and pronominalization when the antecedent occurred in an earlier sentence (optional). (Reflexives and relative pronouns were counted separately and do not contribute to this analysis.) Indices were then developed to serve as a measure of the degree of pronominalization in both environments. Figures calculated were the percentage of time that pronominalization actually occurred when the environment for pronominalization was satisfied. When the antecedent occurred in the same sentence (see Table 21), percentages ranged from 75% at age 10 to 90% at age 18. When the antecedent appeared in an earlier sentence, percentages ranged from 40% at age 10 to 80% at age 18. The high percentage of actual pronominalization when the antecedent was inside the same sentence indicates an awareness of the syntactic requirements on pronominalization in English. The lower percentages of actual pronominalization when the antecedent was outside the sentence in question reflects the stylistic optionality of such pronominalization.

Table 21

Percent of Correct Occurrence of Appropriate Application of Pronominalization Rules in the Written Compositions

Age	10	11	12	13	14	15	16	17	18
Antecedent inside the sentence	75	82	85	92	88	89	90	93	90
Antecedent outside the sentence	40	48	60	66	69	77	83	83	80

Reflexives were used correctly only seven times and by seven different students. One reflexive appeared in an incorrect environment. Relative pronoun findings were presented in chapter 5.

Discussion

In general, the test results indicate that for the deaf students subject and object case pronouns were easier than possessive pronouns and reflexives. This pattern roughly parallels the theoretical order of difficulty and the order suggested in the psycholinguistic literature. For all ages and cases, singular pronouns were easier than plural, again expected on theoretical grounds. First person pronouns tended to be easier than third person, which tended in turn to be easier than second person. Finally, masculine pronouns (with the exception of reflexives, as discussed earlier) were somewhat easier than feminine pronouns, followed finally by neuter pronouns. The analysis of appropriate use of pronominalization in the written sample indicated that with increasing age deaf students become more aware of the syntactic and stylistic constraints on the use of pronominalization rules in English.

One of the most striking features of the results for the deaf children on the pronominalization tests was the number of significant interactions which necessarily modify any generalizations which might be made concerning the order of development of the different pronouns. From these results it appears that the pronoun system is mastered pronoun by pronoun rather than by categories (person, number, case). However, it is still possible to make some generalizations. First person pronouns (singular and plural, subject and object case) were easier (as measured by percent correct) than all other pronouns. The third person singular pronouns (subject and object cases) were also fairly easy, and, together with the first person pronouns, were significantly easier than the third person plural. All were significantly easier than second person singular or plural. These results differ from studies done with young hearing children (Huxley, 1970; Waryas, 1973) which indicated that the speaker/listener distinction (first person/second person) was among the earliest acquired. Here, the first person is among the earliest developed, but it is the third person, not the second, which develops next. One possible explanation for this difference is that the second person is used primarily in direct discourse and is not generally used in writing. Since much of deaf students' experience with language is in its written form, it is possible that the students have much less experience with the second person forms.

The hearing students displayed a pronoun by pronoun pattern of development for the whole pronoun system similar to that of the deaf students and similar to the results reported by Huxley (1970). Furthermore, the hearing students in this study, unlike the deaf students, had theleast difficulty with the first and second person pronouns, paralleling the speaker/listener distinction reported by Huxley and Waryas.

Relative pronouns caused considerable difficulty for both deaf and hearing students. The difference found in subject case and object case for relative pronouns was expected on theoretical grounds, since object relative pronouns require knowledge of the proper semantic features of the noun being replaced and an awareness of the fact that the pronoun has been moved from its canonical position after the verb (simple subject - verb - object) to clause initial position (noun phrase - relative pronoun-subject - verb): The boy whom I saw. However, the results indicated that for personal relative pronouns, the students' performance depended more on whether the pronoun had a human referent than on whether the pronoun served as a subject or object. Quigley, Smith, and Wilbur (1974), also reported in chapter 5, found that the comprehension of relative clauses was affected by the function of the pronoun. Both distinctions, human/non-human and subject/object, are necessary for the development of more complex language.

The results indicated that the correct use of the possessive relative pronoun whose was very difficult for the deaf students. However, the results reported by Quigley, Smith, and Wilbur (1974 and reported in chapter 5) indicated that deaf students were able to make correct judgments of grammaticality of items with the possessive relative whose 50% of the time at age 10, increasing to nearly 80% at age 18. Thus, it appears that deaf students' ability to make grammaticality judgments for sentences containing whose greatly exceeds their ability to use whose correctly in sentences.

It was previously suggested (chapter 6) that object-object deletion and object-subject deletion might be treated as "overpronominalization" -- the deletion of all of the features of a noun phrase rather than just some of the features, as pronominalization does. However, the fact that the deaf students scored so well on the pronominalization tests and the high percentage of proper application of pronominalization within sentences suggest that this view of the deletion rules as overpronominalization may be too simplistic. The pronoun rules appear to be quite well established, suggesting that an alternative explanation for the deletion rules should be sought. One hypothesis that requires further investigation is that the deaf person acquires the conjunction and pronominalization rules reasonably well, but that in the process of acquiring relativization, confusion sets in. This hypothesis implies failure on the part of the deaf person to recognize that conjoining and relativizing are two distinct processes. Such confusion between and and wh-words might lead to a situation in which the word and was used to replace the noun phrase in the same way that the wh-word replaces the noun phrase when a relative clause is formed. This hypothesis receives some support from the generally poor performance of the deaf students on relativization (chapter 5) and their overall high performance on pronominalization.

The analysis of the Reading for Meaning series (McKee, et al, 1966) revealed few uses of pronominalization in the primers; the two first grade texts displayed only one use in every 100 sentences and usage increased to approximately 25 uses per 100 sentences in the fourth, fifth, and sixth grade readers. However, backwards pronominalization appeared even fewer times--in only one sentence per 100 in the fourth and fifth grade readers, with even fewer appearing at other levels. Reflexives occurred only one or two times in a hundred sentences at the second grade level, while possessive pronouns appeared as often as once or twice per 100 sentences only in the third primer and one of the first grade readers.

While the younger deaf students performed fairly poorly on pronominalization, the rules appeared to be quite well established at the older ages; with the relatively low incidence of occurrences in the texts of the structures listed above, the gap appears to be much smaller than with the other structures analyzed. The one exception appears to be possessive adjectives, which appeared much more commonly at an early stage than any of the other pronominal forms: there were four possessive adjectives per 100 sentences in reader 1-1, and 27 in reader 6. Most of these uses would likely be beyond the comprehension of most deaf readers.

CHAPTER 9

QUESTION FORMATION

There are two major categories into which questions fall: yes/no questions and wh-questions. Yes/no questions can be answered by a simple *yes* or *no*, although a more complex answer could be given. (*Do you want to leave now*?--*Yes*; *Yes*, *I do*; *No*. *I have to stay longer*.) Tag questions (John bought a new car, *didn't he*?) are a form of yes/no question; they consist of a declarative sentence followed by a partial question tag. Wh-questions are unlike yes/no questions and tag questions in that they cannot be answered by a simple *yes* or *no*. Wh-questions begin with words like *who*, *when*, *where*, *why*, and *how*. (*Who is he*? *What is an aardvark*?)

To form a yes/no question, the subject and auxiliary verb of the sentence are generally inverted by a rule called *subject auxiliary inversion*, (*John* *is* going to college ⟹ *Is* *John* *going* *to* college?). When there is no auxiliary verb, the verb *do* is provided by the rule of *do-support*, and then inverted with the sentence subject, (*John* left ⟹ *Did John* leave?).

Tag questions involve a complex sequence of transformations: (1) copying the whole sentence (*John left*, *John left*); (2) pronominalizing the second occurrence of the subject (John left, *he* left); and (3) reversing the positive/negative polarity of the tag (John left, he *NEG* left). *Do-support* applies as for yes/no questions (John left, he *do* NEG left), as does *subject-auxiliary inversion* (John left, *do NEG he* left). Adjustment of the tense, deletion of the verb, and contraction produce the final form (John left, *didn't he*?). Notice that when the main sentence is negative, the tag is positive (*John didn't leave*, *did he*?).

Wh-questions in English require the replacement of the element being questioned by the appropriate wh-word (*who*, *what*, *when*, *where*, *why* *how*). Generally, the wh-word is placed in initial position in the sentence. For example, corresponding to the declarative sentence is the wh-question *Who did John see*?, with *who* replacing *John* and moved to the front of the sentence. The subject and the auxiliary are then inverted, unless the wh-word itself is the subject. As with yes/no questions, *do* is inserted when no auxiliary is present. For example:

1. When *is John* leaving?

2. What *does he* want?

but 3. *Who is* going with you?

Related Research

Klima and Bellugi (1966) reported two distinct stages of development in the acquisition of yes/no questions by hearing children. The first stage consists of the use of a sentence nucleus accompanied by rising intonation (See hole?, Mommy eggnog?). At this stage, there are no auxiliaries, so there is no form of subject-auxiliary inversion and no do-support. In the second stage, do-support applies and subject-auxiliary inversion appears, but tenses differ from adult use (Did I saw that in my book?). Bellugi (1971) points out that subject-auxiliary inversion is optional in Standard English in yes/no questions. That is, in the adult grammar, He's going out? (no inversion, but rising intonation) is perfectly acceptable in appropriate circumstances and means basically the same as Is he going out? (with inversion). Bellugi's data indicate, however, that once children begin using auxiliary verbs regularly, they almost invariably apply subject-auxiliary inversion in yes/no questions.

Brown and Hanlon (1970) provided perhaps the only developmental data on tag questions. They reported that tag questions appear only after yes/no questions have been well established. Furthermore, they appear at first as positive tags only, regardless of whether the sentence they question is positive or negative.

For wh-questions, Klima and Bellugi (1966) report three stages of development. In the first, wh-questions are limited to questions of the form What NP (doing) and Where NP (going) (What man doing?, Where Dada?). At this stage, children respond inappropriately to most wh-questions put to them. In the second stage, appropriate responses are given to most wh-questions. What and where generalize to verb forms other than doing and going, indicating a productive rule, and why and why not questions appear. However, auxiliaries at this stage are limited to two forms, always negative, can't and don't. Stage III is characterized by a wider use of auxiliaries but in striking contrast to the development of yes/no questions, subject-auxiliary inversion does not appear in wh-questions until some time after the auxiliaries are established in declarative sentences. At this stage, then, subject-auxiliary inversion is being used in yes/no questions but not in wh-questions. Furthermore, when asked to repeat questions such as Where can he put them? the subjects would respond Where he can put them? Noting the discrepancy between subject-auxiliary inversion in yes/no questions and in wh-questions, Bellugi (1971) furthernotes that when subject-auxiliary inversion does begin to occur with wh-questions, its use with affirmative wh-questions predates its use with negative wh-questions. Thus, there appear to be three stages in the acquisition of the rule of subject-auxiliary inversion: (a) with yes/no questions, (b) with affirmative wh-questions and (c) with negative wh-questions.

Brown (1968) reported that although why questions appear in Stage II, the children who produce them are generally unable to respond appropriately to the same questions until Stage III. Ervin-Tripp (1970) reported on extensive investigation into the comprehension of wh-questions by 24 children. She reported a relative order of ability to respond appropriately: why and who in subject position were easier than how and where from (Where did you get that from?), which in turn were easier than when and who(m) in object position. However, she questions the statistical reliability of this ordering because of great variability in the order of acquisition with different children.

Results

These results are based on the scores of the three question formation subtests (Answer Environments, Auxiliaries and Modals, and Wh-Questions) and on combinations of certain items within the subtests, and are discussed according to question type rather than subtest. Reliability coefficients (Kuder-Richardson 20) are reported for each score along with the number of items used to generate the score. Multivariate analysis of variance was used to determine the appropriate univariate F's and significance levels for all analyses reported.

Yes/No Questions

Comprehension of yes/no questions was measured by the student's ability to select appropriate answers for the questions (for example: Is the baby happy? a. Happy; b. Yes; c. The baby; d. plays). As Figure 30 shows, deaf students improved significantly, F (8,466) = 17.60, $p < .001$, in their ability to choose appropriate answers (6 items, $r = .825$) as age increased from 10 years, where students were correct approximately 48% of the time, to 17 years, where the percentage correct was approximately 94. This increase in percent correct over age represented a significant linear trend, F (1,446) = 130.17, $p < .001$. The hearing children tested had no difficulty in appropriately answering yes/no questions, having correct scores ranging from 96% at age 8 years to 100% at age 10.

Figure 31 shows that deaf students improved in their judgments of grammaticality of yes/no question forms with age (20 items, $r = .807$). These age changes were significant, F (8,446) = 16.39, $p < .001$, and represented a significant linear increase with age, F (1,446) = 123.02, $p < .001$. The hearing

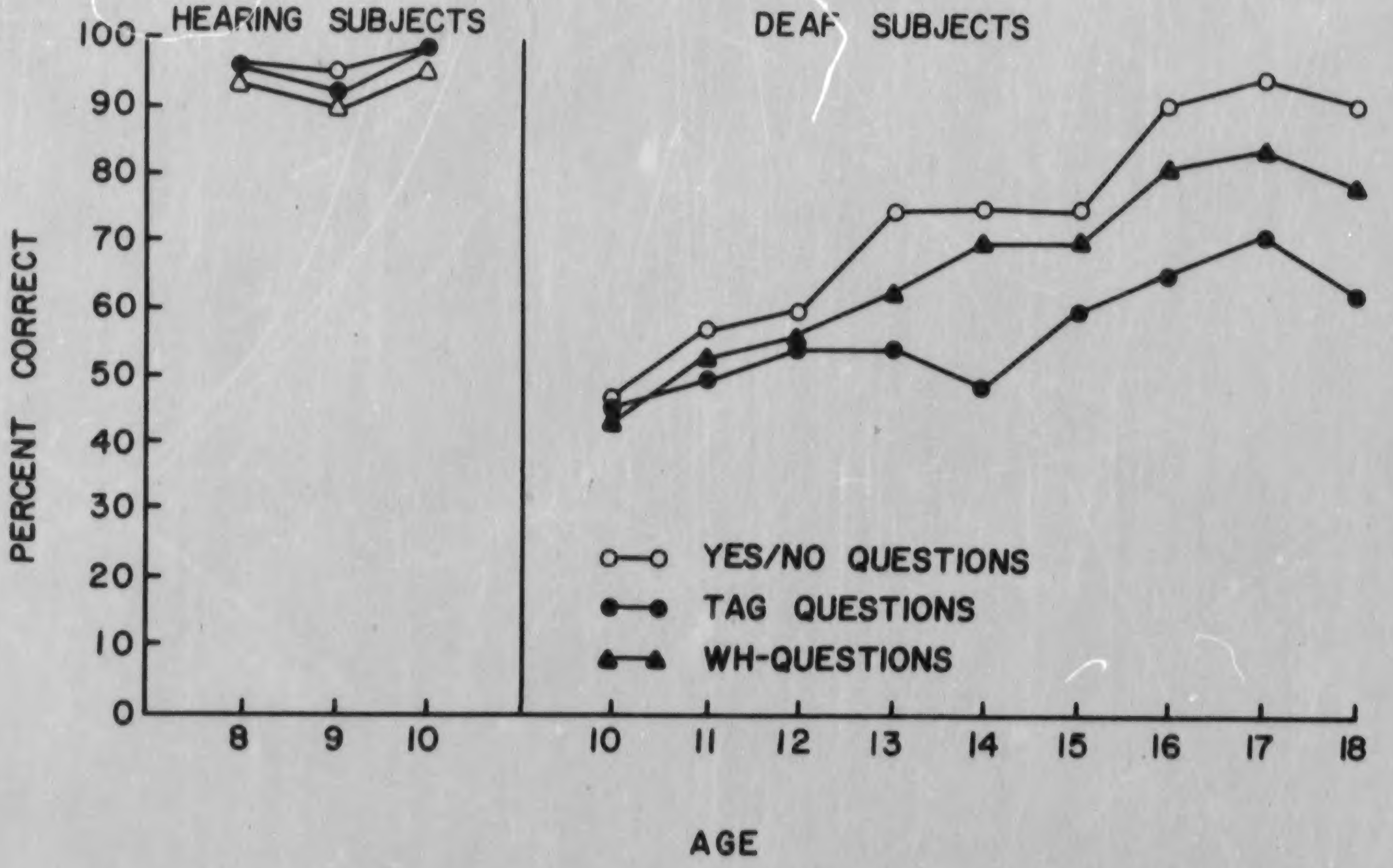


Figure 30. Comprehension of yes/no questions, tag questions, and wh-questions

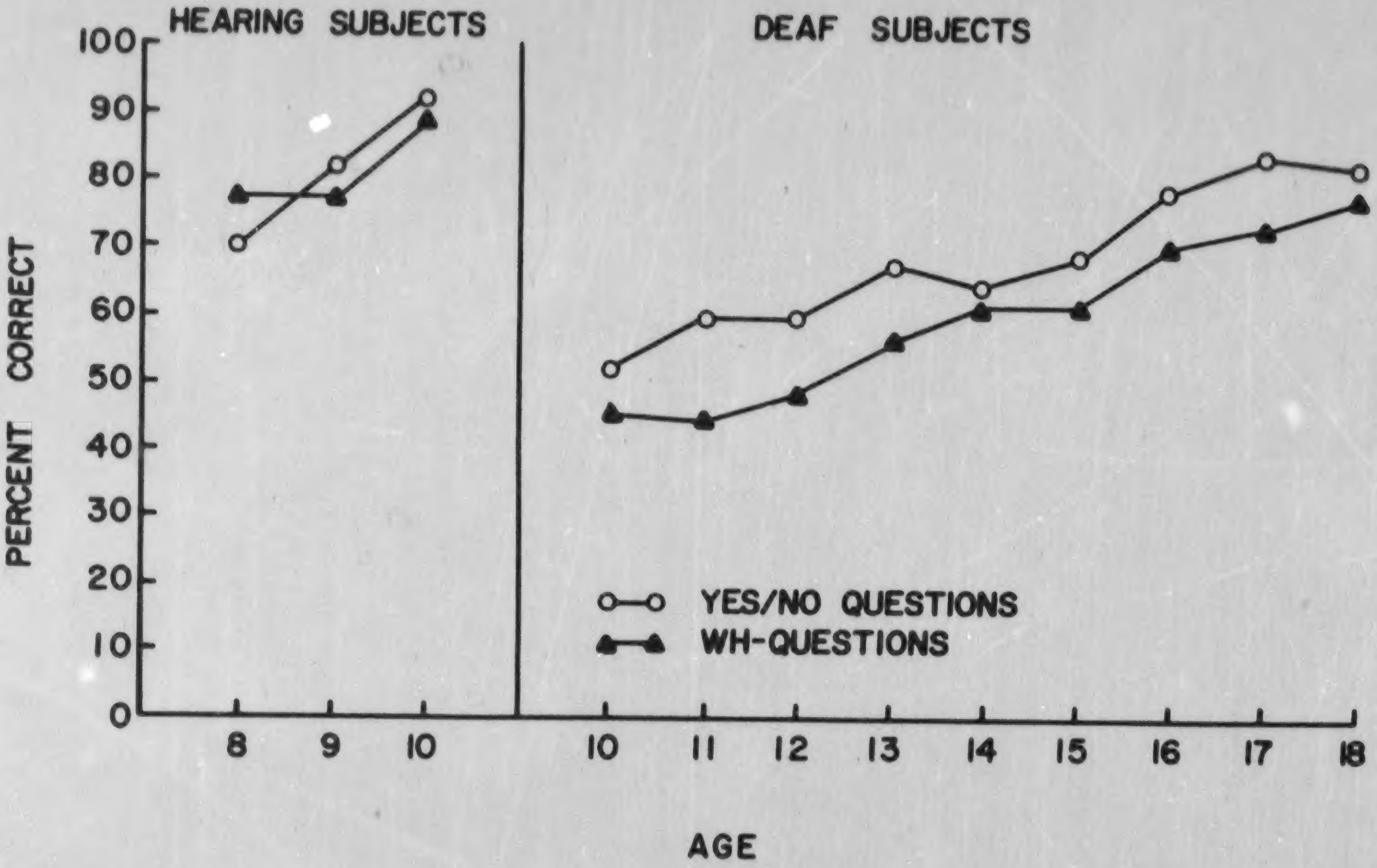


Figure 31. Judgments of grammaticality of yes/no questions and wh-questions

children also showed a significant linear increase with age. The 8-year-old hearing children and the 16-18 year old deaf children were approximately equal in their ability to judge *grammaticality* of yes/no questions in written form, responding correctly between 70 and 80% of the time. Since non-application of *subject-auxiliary inversion* in yes/no questions is acceptable in normal speech under certain conditions if question intonation is used, the relatively low 70-80% correct figure may represent the hearing children's confusion over what is acceptable in writing as compared to speech.

Tag Questions

Students were also asked to choose the most appropriate response to tag questions (e.g., John bought a car *didn't he*? a. I don't know; b. A car; c. Did; d. John). The deaf students were able to answer tag questions (9 items, $r = .335$) appropriately more frequently as age increased, from 44% correct at age 10 years to 71% correct at age 17 (see Figure 30). The age differences were significant, $F\ (8,446) = 3.56$, $p < .001$, and there was a significant linear trend, $F\ (1,446) = 21.95$, $p < .001$, to the data. Again, hearing students had no difficulty selecting correct answers, with correct scores averaging between 94 and 100%.

Wh-Questions

Also shown in Figure 30 is the *comprehension* of wh-questions (56 items from Answer Environment subtest, $r = .950$), based on the students' ability to choose the most appropriate responses to questions of that type (e.g., *Who gave the boys the ice cream*? a. Mother; b. At the store; c. A party; d. Yesterday). Again, there were significant age differences, $F\ (8,446) = 27.64$, $p < .001$, for the deaf students with correct scores ranging from 45% at age 10 years to 80% at 17, as well as a signficant linear trend to the increase in percent correct, $F\ (1,446) = 210.31$, $p < .001$. The hearing children also showed significant age differences ranging from 91 to 99% correct.

Figure 31 shows the mean percent correct for each age group on the wh-questions subtest (44 items, $r = .918$), which measured the student's ability to judge the *grammaticality* of each stimulus question (e.g., *Where the girl work*?, *When did you go home*?) as correct or incorrect. Age differences were significant, $F\ (8,446) = 17.75$, $p < .001$, as was the linear trend, $F\ (1,446) = 138.41$, $p < .001$. Deaf students' judgments of *grammaticality* increased from 44% correct at ages 10 and 11 years to 74% correct at age 18. The judgments of the hearing children were correct from 70 to 90% of the time.

When the wh-question analysis was divided into four subgroups according to the wh-word, and its function, there was a significant interaction between function and age, F (8,446) = 17.94, $p < .001$ (see Figure 32). Post hoc analysis revealed that *who* as a subject (e.g., *Who watched TV?*; 8 items, $r = .730$) was significantly easier than *who* as an object (e.g., *Who did the baby love?*; 12 items, $r = .631$) and *when* (12 items, $r = .804$) across all ages. *Who* in subject position was also significantly easier than *where* (e.g. *Where did the girl work?*; 12 items, $r = .773$) for all but the 10, 12, and 15-year-olds. For younger students, *who* in object position, *where*, and *when* (e.g., *When did the boys play football?*) were equally difficult; however, by ages 16, 17, and 18 years *where* and *when* had been mastered (70-78% correct) to a significantly greater degree than *who* as an object (60-68% correct).

Differences Among the Three Question Forms

In comparing the *comprehension* of all three question types, it was found that there were significant differences among the three forms, F (2,446) = 81.92, $p < .001$, with yes/no questions being the easiest to comprehend (74% correct across all ages), followed by wh-questions (66% correct across all ages), with tag questions being the most difficult (57% correct across all ages). The interaction between age and question type was also significant, F (16,446) = 3.43, $p < .001$. As Figure 30 indicates, the rate of increase in correct answers was greatest for yes/no questions and least for tag questions.

When judgments of *grammaticality* were compared, it was found that yes/no questions were significantly easier than wh-questions, F (1,446) = 105.05, $p < .001$. Yes/no questions had a mean percent correct of 66 across all ages while wh-questions had a mean percent correct of 58. As Figure 31 shows, judgments of *grammaticality* increased over age at about the same rate for both types of questions.

Deviant Structures

Reported here are the results based on systematic structural deviancies, some of which have been found in the written language of deaf students and which indicate problems in the formation of questions.

Inversion. Ability to recognize incorrect inversion as ungrammatical (e.g., Who *the baby did* love?) increased with increasing age for both yes/no questions and wh-questions (18 items, $r = .892$), from approximately 42% correct at age 10 to 85% correct at age 18. The differences among the ages were significant, F (8,446) = 20.64, $p < .001$, as was the increasing linear trend, F (1,446) = 157.70, $p < .001$.

Inversion may be divided into two varieties, failure to apply *subject-auxiliary inversion* (Who *the baby did* love?)

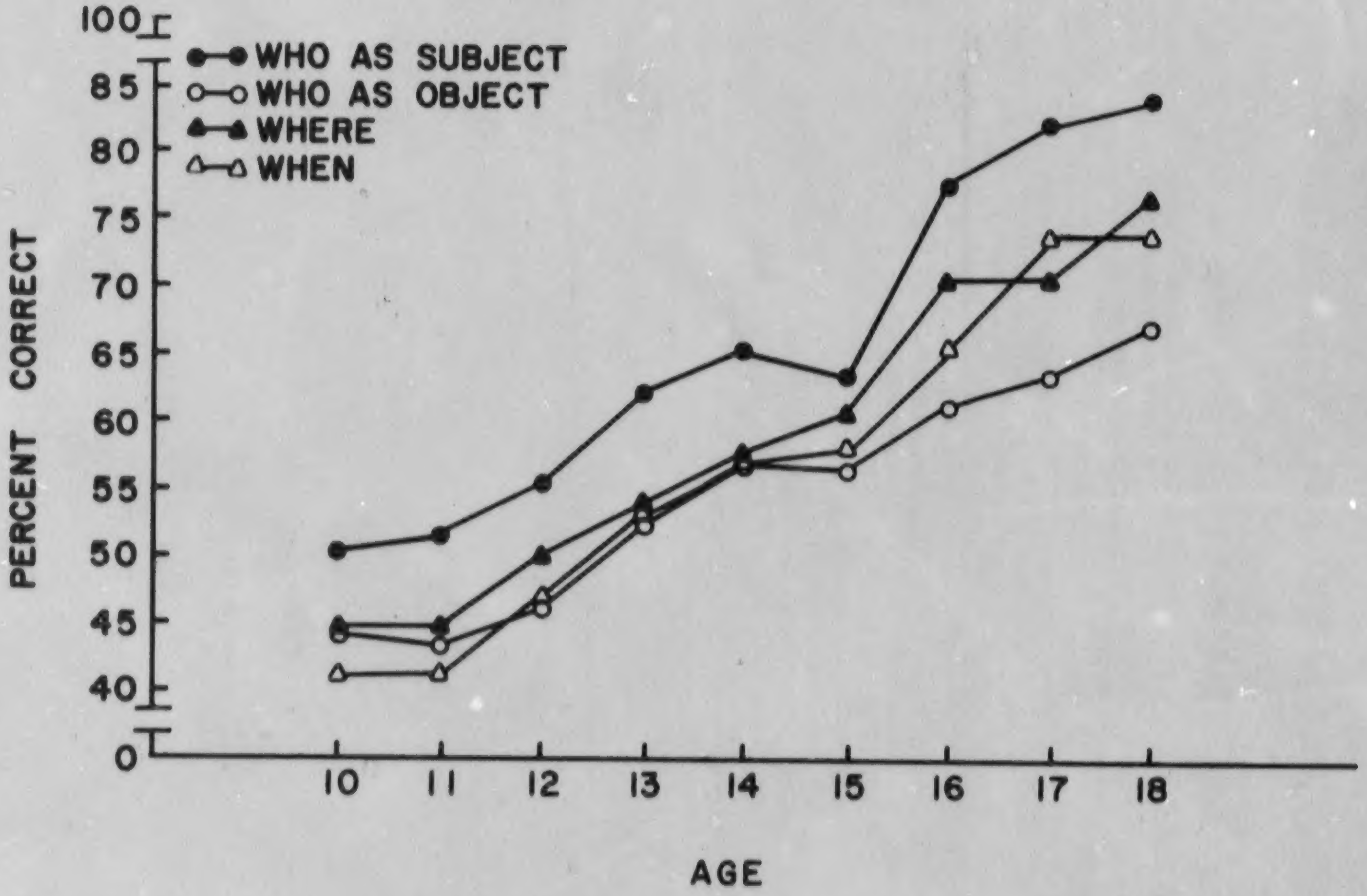


Figure 32. Judgments of grammaticality by deaf students for four types of wh-questions

and incorrect application or non-application of other types of inversion (Who *TV watched*?; The baby *loved who*?). Figure 33 indicates the results when this division was made for the questions used in the present study. Recognition of incorrect inversions of the second type was the least difficult. Judgments concerning the grammaticality of such structures (8 items, $r = .816$) increased in percent correct significantly over age, $F(8,459) = 18.57$, $p < .001$ for the age differences, and $F(1,459) = 142.27$, $p < .001$ for the linear trend. Deaf students had less difficulty with grammaticality judgments for sentences with incorrect *subject-auxiliary inversion* when it occurred in wh-questions (6 items, $r = .808$) than when it occurred in yes/no questions (4 items, $r = .789$). This difference in question type was significant, $F(1,456) = 43.34$, $p < .001$, with wh-questions having a mean percent correct of 65 across all ages and yes/no questions having a mean percent correct of 53 across all ages. Age differences were also significant, $F(8,456) = 15.28$, $p < .001$, and represented significant linear trends, $F(1,456) = 98.49$, $p < .001$ for wh-questions and $F(1,456) = 69.10$, $p < .001$ for yes/no questions.

Hearing children found grammaticality judgments for *subject-auxiliary inversion* in yes/no questions significantly more difficult than the same type of judgments for *subject-auxiliary inversion* in wh-questions. This was perhaps due to the confusion mentioned earlier concerning the differences between what is acceptable in speech and in writing.

Do-Support. Correct judgments of grammaticality of sentences providing a *do-support* environment in both yes/no questions (e.g., *Had John a new car*? *Bought you a new car*?) and wh-questions (e.g., *Where did the girl work*? *Where the girl work*?), increased with age (18 items, $r = .864$). The differences in scores across ages were significant, $F(8,446) = 15.39$, $p < .001$, and there was a significant linear trend to the increases, $F(1,446) = 119.01$, $p < .001$. By age 17 and 18 the deaf students appeared to have equaled the performance of the 8 and 9 year old hearing children.

Copying. As the deaf students increased in age they learned to reject questions where *copying* occurred (e.g., Who *a boy* gave you a ball?; 8 items, $r = .803$). (See chapter 5). The differences among ages were significant, $F(8,446) = 7.20$, $p < .001$, and there was a significant linear trend, $F(1,446) = 46.39$, $p < .001$. However, the oldest students still accepted sentences with copying as correct 37% of the time. These results are similar to those found by Quigley, Smith, and Wilbur (1974) for relative clauses, which are graphed in Figure 34.

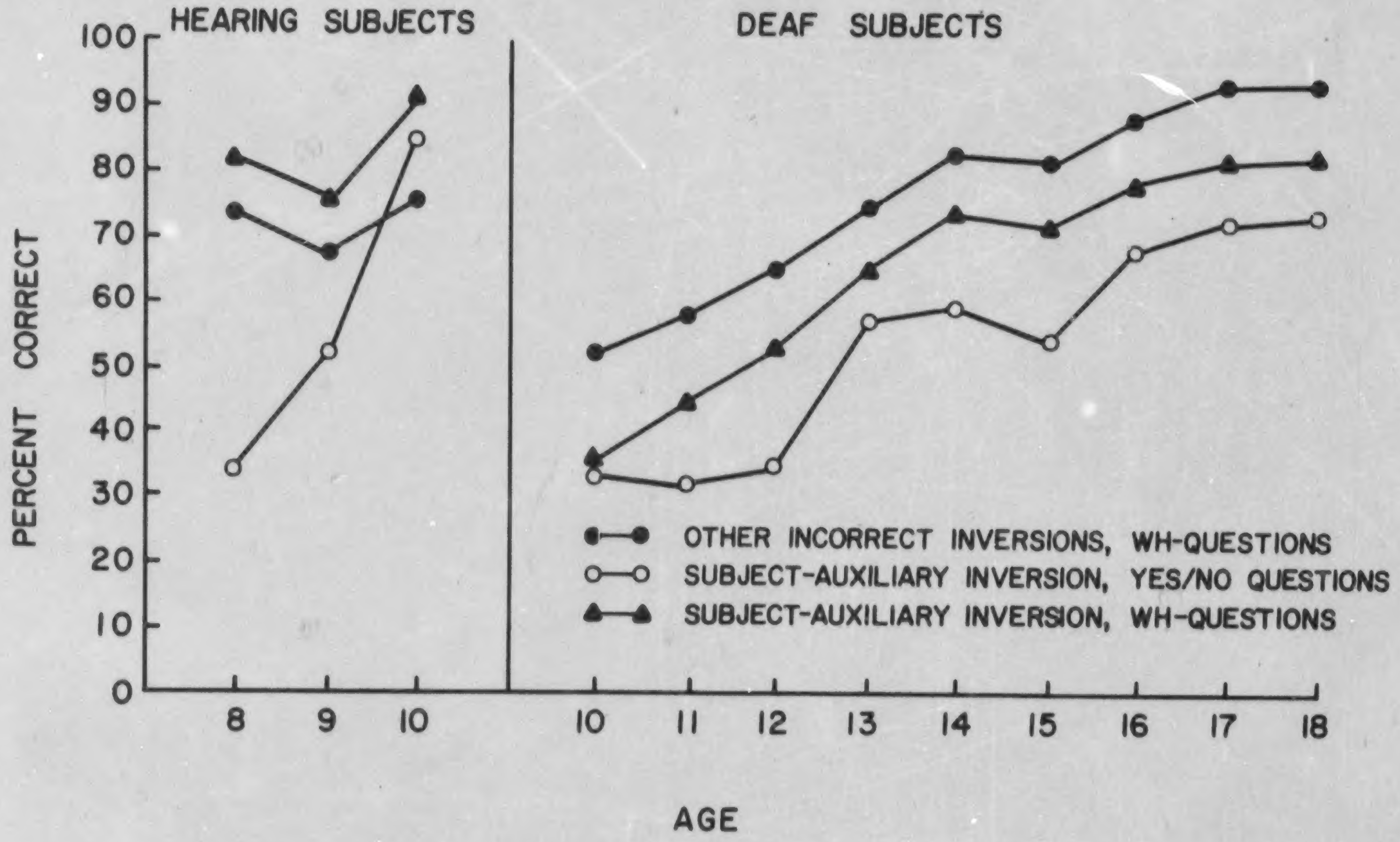


Figure 33. Judgments of sentences with incorrect subject auxiliary inversion (both question types) and other incorrect inversions (wh-questions only)

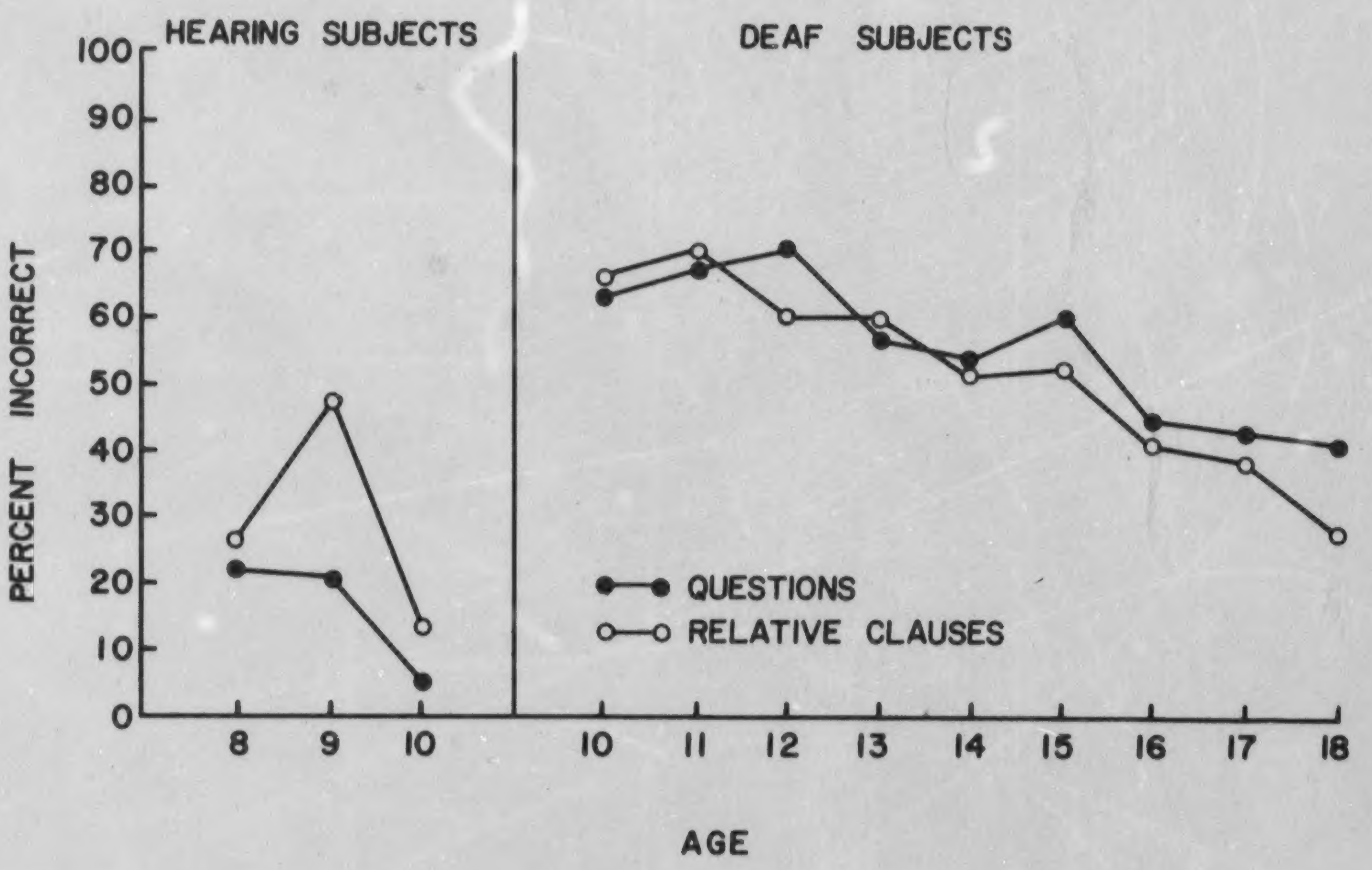


Figure 34. Incorrect acceptance of copying in questions and relative clauses

Written Language Sample

Both wh-questions and yes/no questions were produced in the writing of only about 3% of the deaf students. This might have been partially a result of the task type: that of writing a description of a picture. For wh-questions, 14 students produced just 20 uses; at least one wh-question was used at each age except 17, while only the 18-year-olds produced more than this--six uses by 4 students out of 50. For the hearing sample, 5 students (5% of the total) each produced one question of this type. Similarly, 14 students produced yes/no questions (a total of 24 uses), at all ages 11 to 18. One 17-year-old produced 7 of these questions, but most students wrote only one. Three hearing students (5%) provided just 4 yes/no questions. Only one tag question occurred in the entire writing sample, produced by a deaf 16-year-old, not one hearing child used a yes/no question. Tag-questions were also most difficult in the TSA.

Wh-questions, subject wh-words, and object wh-words were used equally frequently by the deaf students. Subject-auxiliary inversion was applied 47 times by just 14 students (3%); one 12-year-old applied it 20 times and one 18-year-old 10 times. Only 7 hearing children (12%) applied subject-auxiliary inversion. There were 7 incorrect applications of the rule by deaf children between the ages of 11 and 16, while hearing children made no such errors. Finally, where there were 10 instances of copying produced by the deaf students, they were all written by one 15-year-old student; it appears that in question-formation at least, copying is an individual problem of certain deaf students rather than a general one common to all. None of the hearing students applied copying.

The infrequent occurrence of question forms in the written samples indicates the inadequacy of this means for studying the language of deaf children. Structured situations, such as provided by the TSA, are necessary for systematic examination of language structure.

Discussion

The results of this study indicate the general difficulty which profoundly, prelingually deaf persons have in comprehending questions and in judging the grammaticality of question forms. The rules for the formation of questions appeared to be poorly established in the younger deaf students, as evidenced by their chance level of performance on measures of comprehension and judgments of grammaticality. There was a steady increase in comprehension and judgments of grammaticality. There was a steady increase in comprehension of all three question types with increasing age; however, only for yes/no questions (theoretically the least complex) did the deaf students approach the level of *comprehension* of the much younger hearing children. Correctness of judgments of *grammaticality* of yes/no questions and wh-questions appeared to develop at a slower rate than comprehension of the same question forms, although at a more rapid rate than comprehension of tag questions.

That there are developmental stages in the acquisition of questions for deaf students is suggested by the results indicating that comprehension of yes/no questions was easier than comprehension of wh-questions which, in turn, was easier than comprehension of tag questions. It was also easier for deaf students to make correct judgments of grammaticality on the yes/no question stimuli than on the wh-question stimuli. This is in line with the order of difficulty predicted by transformational theory and recorded as the order of emergence in young hearing children by Klima and Bellugi (1966) and Brown and Hanlon (1970). Thus, it would appear that the major stages in the development of question formation would follow the same order for both deaf and hearing students, although deaf students seem to go through the stages much later in their chronological development.

Further evidence of similarity in stages of development between deaf and hearing children can be found by examining the results for judgments of grammaticality based on the type of wh-word. Ervin-Tripp (1970) reported that *who* in subject position was easier for young children to understand than *when*, and *who* in object position. These results exactly parallel the present study's findings for judgments of grammaticality made by deaf students.

The emergence of the ability to correctly apply inversion with proper restrictions also shows stages of development, although results from the present study appear to indicate a different order from that found by others (Klima and Bellugi, 1966, Bellugi, 1971) in studies of spontaneous emergence of inversion in the language of young hearing children. When asked to judge the grammaticality of questions containing incorrect application or nonapplication of inversions other than *subject-auxiliary inversion* (*The dog chased who*? Who *TV watched*?), deaf students were able to judge them as ungrammatical with a fair degree of success. Hearing students had more difficulty, perhaps because questions of the form *The dog chased who*? are acceptable in spoken English (with appropriate intonation) and have been hypothesized by Brown (1968) to be a stage in the development of wh-questions. Both deaf and hearing students had more difficulty with judgments of incorrect *subject-auxiliary inversion* in yes/no questions than in wh-questions, which is contrary to the findings of most studies of the order of emergence of questions. It might be that judgments of grammaticality are more difficult for yes/no questions without *subject-auxiliary inversion* (The dog is brown?) because the structure is the same as that of a simple declarative sentence (The dog is brown?), and because the structure can be made acceptable as a question in speech by the use of rising intonation. Failure to apply subject-auxiliary inversion in wh-questions, on the other hand, produces clearly ungrammatical questions of the form Who the baby did love?, which is not likely to be confused with another structure.

Despite the overall similarity between deaf students and hearing students in the development of the various question forms, the results for copying indicated that there might be deviant rules in the written language of deaf individuals which co-exist with the standard rules for English. Copying has been found frequently in the written language of deaf children, particularly in relative clauses (Quigley and Power, 1972) and was tested (see chapter 5) to discover if deaf students would accept, as correct, items with copying. Redundancies (such as copying) have been reported in the spontaneous language of hearing children (Menyuk, 1964), but not in questions or relative clauses. As was reported in chapter 5 the hearing children in this study accepted copying in relative clauses, although to a lesser degree than deaf children. Copying was included in the question tests to test for its acceptability, even though it had never appeared in the written questions of deaf students. Again, both hearing and deaf students showed patterns of acceptance of copying which were similar to those found for relative clauses.

The analysis of the Reading for Meaning series (McKee, et al, 1966) showed that yes/no questions were present in the first primer, and wh-questions in the second. Yes/no questions occurred roughly 8 times per 100 sentences in the third primer and first grade reader, after which their occurrence dropped to 3 per 100 sentences by the sixth grade level. Wh-questions occurred 11 times per 100 sentences in the third primer and dropped to 6 per 100 by the sixth grade level. Only conjunction, negation, and the modal verbs occurred with greater frequency throughout all reading levels. The rule of do-support in all its usages was applied equally frequently: 8 times per 100 sentences in the third primer, 11 times per 100 in reader 1-1, and between 5 and 7 times per 100 in all succeeding readers. Yet, as the present results indicate, deaf students have considerable difficulty comprehending questions, particularly the younger students who are likely to encounter the greatest proportion of questions in their reading texts.

CHAPTER 10

NEGATION

The adult process of negation, which presumably serves as the model for children learning the language, requires that the negative element be placed in the proper position in the verb phrase. (For a complete description in generative transformational terms, see Klima, 1964.) If there is an auxiliary or modal verb (*be*, *can*, *will*, etc.), the negative element directly follows it (I can *neg* go, I am *neg* eating lunch). If no auxiliary or modal verb is present, a form of the verb *do* is inserted by a rule of *do-support*, and the negative element follows it (Mary *do neg* throw the ball which becomes Mary *did not* throw the ball). The negative generated in the deep structure of the sentence becomes a negative morpheme such as *not* or *no* on the surface. In addition, if certain stress conditions are met (Zwicky, 1970), some auxiliary verbs (*can*, *be*, *do*, *have*, *will*) permit contraction with *not* (*can't*, *isn't*, *don't*, *haven't*, *won't*).

Three stages of syntactic development of negation are described extensively by Bellugi (1967). In Stage I of the syntactic development of negation, the negative element is placed entirely outside the sentence (that is, before the sentence: *No* want sleep, or after the sentence: Sleep *no*). In Stage II, the negative element is placed inside the sentence, generally after the subject of the sentence. At this stage the negative element appears as *no*, *not*, *can't* or *don't*. *Do-support* is not active at this stage, as is evidenced by the fact that *do* does not appear in isolation although *don't* does. Furthermore, no auxiliary verbs are being used at this stage, suggesting that *can't* and *don't* have been memorized in an unanalyzed form, rather than derived from *can + not* and *do + not*. Stage III may be characterized as having a functioning rule of *do-support*, the occurrence of other types of auxiliary verbs, proper placement of the negative element, and an optional rule of contraction, thus being syntactically equivalent to the adult process of negation.

Results

This chapter addresses itself to the syntactic development of negation in the language of deaf children. The three stages just discussed were investigated in terms of three salient features: placement of the negative element, application of *do-support*, and application of the contraction rule. These three features were, in turn, considered for several verb types. The items from the two TSA subtests dealing with negation (Be and Have, Modals) were regrouped into four categories based on the type of verb: *Be*, *Do*, *Have*, and *Modals*. Analysis was conducted based on this item grouping. Multivariate analysis of variance was used to determine the appropriate univariate *F*'s and significance levels for the analyses. Table 22 gives the percent correct scores and the significance levels of these item groupings.

Table 22

Percent Correct Scores for *Be*, *Do*, *Have*, and *Modals* Subgroupings Along with *F*'s for Age Differences and Linear Trends

	Hearing students			Deaf students								
	Age			Age								
	8	9	10	10	11	12	13	14	15	16	17	18
Be	89	87	95	60	70	76	78	82	81	88	88	86
Do	89	89	97	53	59	65	69	73	72	80	83	82
Have	81	76	90	57	66	72	72	77	78	81	81	78
Modals	87	87	92	58	70	72	77	82	81	87	88	87

	Deaf students					
	Age			Linear trend		
	F	df	*p* <	*F*	df	*p* <
Be	16.52	8,452	.001	112.45	1,452	.001
Do	18.48	8,452	.001	140.36	1,452	.001
Have	9.36	8,452	.001	59.18	1,452	.001
Modals	18.50	8,452	.001	129.66	1,452	.001

Neg Placement

Outside of the sentence. Students were asked to judge the grammaticality of sentences in which the negative element had been placed outside of the basic sentence structure in order to assess their progress with respect to the first stage in the development of negation. The negative either preceded the sentence (Neg-S: No the elephant can talk) or followed the sentence (S-Neg: The man see a lion not), and the sentences used contained modal verbs, be, have, or do.

For all verb types combined, deaf students correctly rejected S-Neg sentences ($\bar{X}$ = 81%) more frequently than Neg-S sentences ($\bar{X}$ = 76%). This difference was significant, F (1,452) = 23.56, $p < .001$. Correct judgments increased with age for both S-Neg and Neg-S, as can be seen in Table 23. Results for the hearing students, while not reflecting the age trend, did reflect the finding that S-Neg was easier (for all verbs) than was Neg-S. This may have been due to the fact that some Neg-S sentences resemble grammatical sequences of no followed by a pause (No, the boy has a pencil); and since the students were not told to be concerned with punctuation, they might have judged these sentences as correct because of the strong similarity between the two types. S-Neg sentences do not bear any similarity to Standard English forms, and thus would not produce the same confusion.

Inside the sentence but inappropriately used. In the acquisition of negation by hearing children, the second stage (reported by Bellugi, 1965) is the placement of the negative inside the sentence, but not necessarily in the correct location or with appropriate adjustments of tense, do-support, or negative form (no or not). Students were asked to judge the correctness of sentences which contained errors of these varieties. Unlike the results with Neg outside the sentence, negatives placed inside the sentence did not show a consistent pattern across all verb types.

Incorrect sentences with modal verbs were presented in one of two ways: either the negative preceded the modal (Neg-Modal: Dogs not can build nests in trees) or it followed the modal but had the wrong form (Modal-Neg: Fish can no play football). Correct grammaticality judgments increased significantly with age both with Neg preceding the modal and the Neg (incorrect form) following the modal (see Table 24). A comparison of the two revealed a significant interaction with age, F (8,459) = 2.53, $p < .001$, which was the result of Neg-Modal being more difficult than Modal-Neg for the younger students but easier for the older students. Hearing students' scores were slightly higher with Modal-Neg than with Neg-Modal.

For sentences with be as the main verb, students were asked to make correctness judgments for sentences in which the negative

Table 23

Percent Correct Scores and Significance Levels for Items with the Negative Outside the Sentence

	Hearing students			Deaf students								
	Age			Age								
	8	9	10	10	11	12	13	14	15	16	17	18
S-Neg												
Be	96	92	98	57	72	76	77	88	83	95	93	90
Do	94	94	98	54	65	72	78	87	80	93	95	88
Modals	93	89	97	65	71	77	80	90	85	93	96	92
Have	91	89	99	65	72	77	74	96	82	92	93	85
Neg-S												
Be	75	65	87	58	70	71	74	80	77	83	85	83
Do	90	85	94	57	64	66	78	81	78	83	85	88
Modals	79	66	85	59	65	67	75	79	80	83	86	87
Have	93	89	97	62	71	76	75	82	77	89	85	83

	Deaf students					
	Age			Linear trend		
	F	df	p <	F	df	p <
S-Neg	11.70	8,452	.001	78.44	1,452	.001
Neg-S	7.37	8,452	.001	52.34	1,452	.001

Table 24

Percent Correct Scores and Significance Tests for Modals

	Hearing students			Deaf students								
	Age			Age								
	8	9	10	10	11	12	13	14	15	16	17	18
Neg-Modal	87	89	91	64	65	65	67	75	83	86	93	88
Modal-Neg	87	92	100	61	66	71	76	80	75	88	81	86

	Deaf students							
			Age			Linear trend		
	# items	*r*	*F*	df	*p* <	*F*	df	*p* <
Neg-Modal	4	.630	8.86	3,459	.001	64.17	1,459	.001
Modal-Neg	4	.339	7.18	8,459	.001	47.01	1,459	.001

preceded *be* (Neg-*be*: The baby *not* is happy) and where the negative followed *be* but had the wrong form (*be*-Neg: A mouse is *no* a big animal). Again, correct judgments increased with age (see Table 25). Across all ages, the deaf students were correct more frequently for judgments of Neg-*be* ($\bar{X}$ = 77%) than for *be*-Neg ($\bar{X}$ = 63%), F (1,452) = 56.20, $p < .001$. Hearing children had little difficulty making grammaticality judgments for either Neg-*be* or *be*-Neg.

Results for sentences with *have* as the main verb were similar, but the differences between Neg-*have* and *have*-Neg were even more pronounced. Grammaticality judgments of sentences of the form *The girl no has a new dress*, (Neg-*have*) improved with age, but grammaticality judgments of sentences like *The boy has no* a pencil (*have*-Neg) did *not* change with age (see Table 26). Across all ages, Neg-*have* ($\bar{X}$ = 75%) was significantly easier than *have*-Neg (X = 47%), F (1,464) = 248.05, $p < .001$, and there was a significant interaction, F (8,464) = 3.92, $p < .001$, of the two structures due to the increase in percent correct for Neg-*have* over age and the lack of change in *have*-Neg. Hearing students also found Neg-*have* easier than *have*-Neg.

Do-support

In the development of negation in hearing children, once the negative has been placed inside the sentence, the next stage is the development of the ability to correctly apply *do-support*. Students were asked to judge Neg-*do*-verb (The man *not did see* a lion), *do*-neg-verb (The boy *did not go* to school), and Neg-verb (The children *not play* in the park--where *do-support* has not been applied). (See Table 27 for percent correct scores and significance tests).

As was found with other verb types, when the negative preceded the verb inside the sentence (in this case Neg-*do*-verb; X = 71%), students had less difficulty than when the negative followed the verb (*do*-Neg-verb; $\bar{X}$ = 47%), F (1,459) = 2.25, $p < .02$. When *do-support* has not been applied (Neg-verb) deaf students' scores (X = 59%) were significantly better than with *do*-Neg-verb, F (1,459) = 74.78, $p < .001$, and poorer (but not significantly so) than with Neg-*do*-verb (see Figure 35). In contrast, hearing students had little difficulty with any of the error types.

Contraction

Contraction of the negative with the auxiliary has been reported to be the final stage in the acquisition of negation in young hearing children. Subjects in the present study were asked to judge the grammaticality of grammatical sentences in which the

Table 25

Percent Correct Scores and Significance Tests for *Be*

	Hearing students			Deaf students								
	Age			Age								
	8	9	10	10	11	12	13	14	15	16	17	18
Neg-be	95	85	100	56	64	79	75	84	79	85	89	82
be-Neg	87	92	100	48	55	61	58	64	72	62	75	76

			Deaf students					
			Age			Linear trend		
	# items	*r*	*F*	df	*p* <	*F*	df	*p* <
Neg-be	4	.737	6.52	8,452	.001	35.80	1,452	.001
be-Neg	2	.662	2.77	8,452	.005	18.70	1,452	.001

Table 26

Percent Correct Scores and Significance Tests for *Have*

	Hearing students			Deaf students								
	Age			Age								
	8	9	10	10	11	12	13	14	15	16	17	18
Neg-have	94	89	100	57	58	73	75	83	78	83	87	82
have-Neg	71	61	77	47	43	44	41	40	53	49	53	50

			Deaf students					
			Age			Linear trend		
	# items	*r*	*F*	df	*p* <	*F*	df	*p* <
Neg-have	4	.807	5.99	8,464	.001	37.05	1,464	.001
have-Neg	4	.683	NS			NS		

Table 27

Percent Correct Scores and Significance Tests for *Do*-support

	Hearing students			Deaf students								
	Age			Age								
	8	9	10	10	11	12	13	14	15	16	17	18
Neg-do-Verb	84	77	93	52	55	61	64	76	80	83	84	85
do-Neg-Verb	83	82	96	37	32	43	46	41	48	53	64	62
Neg-Verb	90	90	99	40	42	49	52	61	60	71	78	76

		Deaf students						
			Age			Linear trend		
	# items	*r*	*F*	df	*p* <	*F*	df	*p* <
Neg-do-Verb	4	.701	10.00	8,459	.001	75.26	1,459	.001
do-Neg-Verb	6	.688	7.19	8,459	.001	48.55	1,459	.001
Neg-Verb	4	.675	10.15	8,459	.001	78.37	1,459	.001

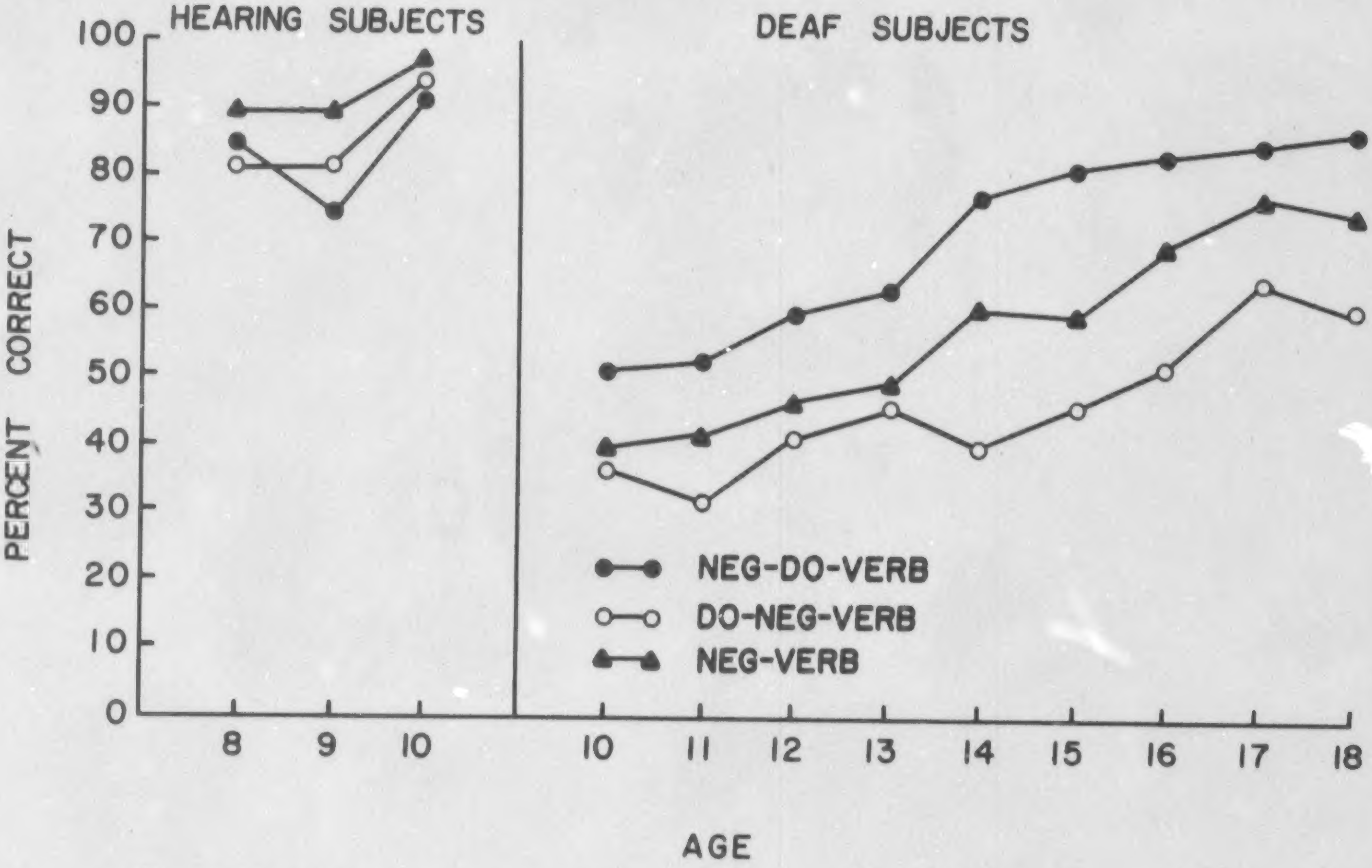


Figure 35. Placement of negative inside the sentence with application and non-application of do-support

negative and the verb were not contracted (e.g., Rabbits *cannot* fly), versus those in which they were (e.g., Rabbits *can't* fly). (Both types were considered to be equally grammatical.) Table 28 gives percent correct scores and significance levels for each of the different verb types in its contracted and uncontracted form.

With modal verbs, deaf students (averaged across age) were slightly better able to make correct judgments when contraction had occurred ($\bar{X} = 82\%$) than when it had not ($\bar{X} = 80\%$), F (1,459 = 4.74, $p < .03$. Students improved steadily over age in their ability to make such judgments. For sentences with *be*, sentences with contraction ($\bar{X} = 87\%$) were less difficult to judge correctly than sentences without contraction ($\bar{X} = 83\%$). Again, judgments of both types of sentences improved with age. For sentences with *do* there were no differences between contracted structures and uncontracted structures, but scores for both increased over age. Hearing students had little trouble with either contracted forms or uncontracted forms and there were no differences between the two forms.

Overgeneralization of contraction to verbs which do not permit simple contraction has been observed in the development of negation in hearing children (Berko, 1958). As Figure 36 indicates, deaf students accepted the incorrect contractions *willn't* and *amn't* to a greater extent than did hearing students. Age differences were significant for both *willn't* and *amn't* and represent a linearly decreasing trend (see Table 28), but acceptance of these forms by deaf students was still high even at 18 years (56% and 42%).

Comparison of Stages of Development

When the students' judgments of grammaticality for sentences with the negative outside the sentence (S-Neg and Neg-S) were compared to those for ungrammatical sentences with the negative inside the sentence (Neg-Modal, Modal-Neg, etc.), it was found that sentences with the negative outside the sentence were easier to judge than those with the negative inside the sentence for all four verb types (see Table 29 for means and significance levels).

A further comparison was also made between all correct sentences, and all incorrect sentences both with the negative outside the sentence and with the negative inside the sentence. Correct negative sentences were judged correctly more frequently than were the incorrect negative sentences for all verbs (Table 29).

Finally, sentences with the overgeneralized contractions *willn't* and *amn't* were compared with all other negative sentences with the same base verbs. *Willn't* was significantly more

Table 28

Item Reliabilities and Significance Levels for Contracted and Uncontracted Negatives

	Hearing students			Deaf students								
	Age			Age								
	8	9	10	10	11	12	13	14	15	16	17	18
Contracted with modal	87	95	93	57	76	79	82	87	88	92	89	89
Uncontracted with modal	91	92	89	56	75	74	82	87	82	90	87	91
Contracted with be	91	96	94	68	79	86	90	88	91	97	93	91
Uncontracted with be	90	96	96	66	76	78	84	84	83	94	91	92
Contracted with do	90	96	97	69	81	87	88	90	89	98	93	95
Uncontracted with do	94	100	100	71	83	86	86	91	83	95	95	93
Willn't	70	62	95	30	30	36	28	23	36	38	55	44
Amn't	90	77	97	30	27	40	35	35	49	49	63	58

	Deaf students							
			Age			Linear trend		
	# items	r	F	df	p <	F	df	p <
Contracted with modal	14	.867	13.78	8,459	.001	78.23	1,459	.001
Uncontracted with modal	10	.874	9.62	8.459	.001	57.08	1.459	.001
Contracted with be	10	.775	12.03	8,452	.001	65.68	1,452	.001
Uncontracted with be	8	.784	8.01	8.452	.001	53.66	1,452	.001
Contracted with do	4	.697	7.69	8,459	.001	45.51	1,459	.001
Uncontracted with do	4	.594	6.86	8,459	.001	38.02	1,459	.001
Willn't	2	.794	2.63	8,459	.008	9.52	1,459	.002
Amn't	2	.781	4.13	8,452	.001	27.66	8,452	.001

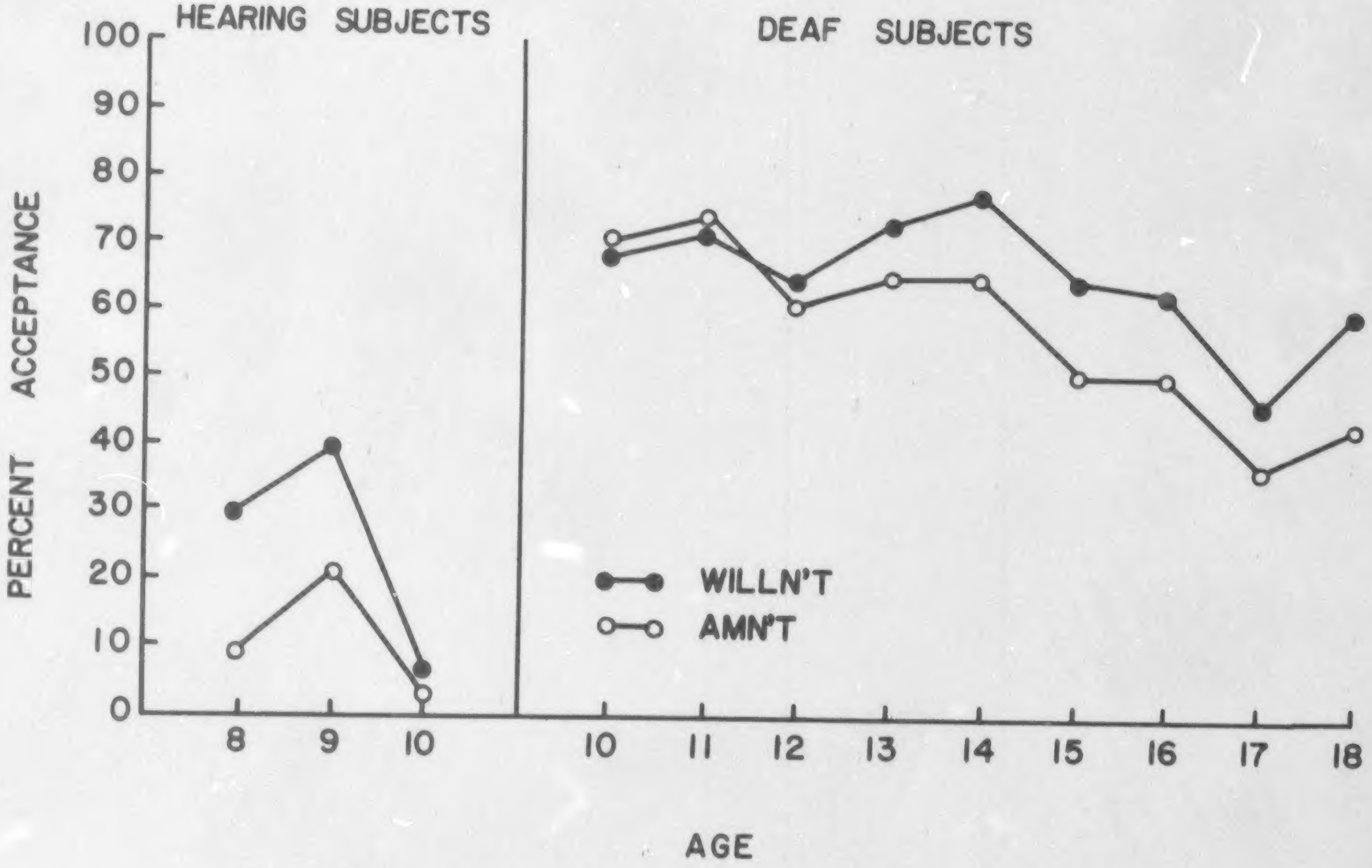


Figure 36. Acceptance of amn't and willn't as grammatical

Table 29

Comparison of Stages of Development of Negation Based on Students' Judgments of Grammaticality

		$\overline{X}$	$\overline{X}$	F	df	p <
		Outside	Inside			
Incorrect negatives outside sentence vs. Incorrect negatives inside sentence	Modals	79.4%	76.11%	14.86	1,459	.001
	be	78.4%	70.22%	52.97	1,452	.001
	have	79.2%	60.9%	234.43	1,464	.001
	do	77.4%	59.07%	1.84	1,459	.06
		Correct	Incorrect			
Correct sentences vs. Incorrect sentences (Neg both inside and outside)	Modals	81.28%	77.76%	13.08	1,459	.001
	be	85.06%	74.31%	73.38	1,452	.001
	have	81.28%	70.05%	54.83	1,464	.001
	do	87.39%	68.19%	2.74	1.459	.005
		Willn't	Other Modals			
Willn't vs. all other modals		35.6%	79.52%	437.33	1,459	.001
		Amn't	Other be			
Amn't vs. all other be		42.9%	79.69%	270.66	1,452	.001

difficult to judge (as incorrect) than were other modals, and amn't was significantly more difficult than were other be verbs. Deaf students frequently did not recognize either of these forms as incorrect (Table 29).

Written Language Sample

On the whole, the students appeared to have negative placement fairly well mastered in their production, with correctly formed negatives accounting for 93% of the total; 101 students (21%) produced 182 correctly positioned negatives at all ages from 10 to 18, with only 3% of the students (13) producing just 14 sentences with the negative incorrectly placed. Thirteen hearing students (22%) produced correctly placed negatives, while no incorrect usages occurred.

Surprisingly, there were no instances of incorrect application of do-support. However, 12 deaf students (3%) and one hearing student (2%) failed to apply do-support in the proper environment at least once. Do-support was applied when necessary in 82% of the possible cases (71 of 87 environments) by deaf students.

Ten percent of the deaf students (48 students) correctly contracted not to n't, with many of them doing so more than once. Nine of the hearing students (15%) were able to do so.

All instances of incorrect negative placement involved negatives placed within the sentence; no deaf or hearing students produced Neg-S or S-Neg structures. Also, there were no occurrences of amn't or willn't, despite the use of such forms as found in earlier studies.

The analysis of the Reading for Meaning series (McKee, et al, 1966) revealed that negative sentences appeared 13 times per 100 sentences in the very first primer; in the sixth grade reader, there were 9 usages per 100 sentences. In texts at all other levels, occurrence of negative sentences varied only from 7 per 100 to 15 per 100. Although the number of occurrences did not rise to the high level of some processes such as forward pronominalization and for-to complementation, the consistently high numbers from the first primer on clearly predicts great difficulty for deaf students using these readers. Although their overall performance was good compared to more difficult structures, with negation being quite well mastered by 16-18 years of age, younger students performed very poorly in their grammaticality judgments, and would likely encounter difficulty in reading materials so heavily loaded with negatives.

Discussion

The results of the study suggest that deaf students have basically mastered the process of negating sentences by age 16-18 years. Their performance is quite good, especially when compared to other syntactic structures such as relativization (chapter 5). In comparing these findings with those of other researchers, one should consider that the students have been asked to judge the grammaticality of sentences. As the results from question formation (chapter 9) indicate, such judgments may be more difficult for students to make and would, thus, give lower estimates of the students' knowledge of the rules of English than would measures of comprehension or production such as those that have been used by other researchers.

These results suggest that the order of the stages of acquisition is similar for deaf and hearing students, but the rate of acquisition appears to be much retarded for deaf students. Structures with the negative outside the sentence (Stage I) were significantly easier to judge as incorrect than ungrammatical sentences with the negative inside the sentence (Stage II). Within the sentence, judgments of grammaticality for verbs which do not require do-support (Stage II) were less difficult than for those requiring do-support (Stage III). Despite the similarity between the developmental stages reported for hearing children and those reported here, some possible substages have been noted in the data from the deaf students. Bellugi's (1965) Stage I included both placement of the negative preceding the sentence (Neg-S) and placement of the negative following the sentence (S-Neg). The present research indicates that there might be two substages within Stage I for deaf students: first S-Neg, then Neg-S. Stage II as reported for young hearing children included all negative placements inside the sentence (both correct and incorrect). In general, results for the deaf students suggest that the incorrect structures with the negative preceding the verb (Neg-Modal, Neg-be, and Neg-have) are easier for students to judge than grammatical structures with the negative following the verb (Modal-Neg, be-Neg, and have-Neg). Furthermore, for do, structures with the negative preceding the verb may be further divided, with Neg-do-verb being easier than Neg-verb (where do-support is lacking). In contrast to the findings of Bellugi (1967) that contraction is among the last steps in the acquisition of negation, contracted negatives were easier than uncontracted negatives for deaf students. Moreover, contracted negatives were easier than all other stages in the acquisition of negation. In fact, this preference for contraction extended to verbs which do not permit contraction in Standard English (willn't and amn't). Such overgeneralization has been reported for young hearing children (Berko, 1958, Menyuk, 1969) and its prevalence across all ages in the deaf sample adds support to the hypothesis that deaf students' acquisition of some aspects of syntax parallels that of hearing children but at a greatly retarded rate.

CHAPTER 11

THE VERB SYSTEM

A verb has traditionally been defined as a word which expresses an action or a state of being; it forms the core of a sentence. Linguistic theory recognizes two kinds of main verbs. The first comprises ordinary verbs, which are subdivided into those which require an object (i.e., transitive verbs like throw in John threw the ball) and those which do not require an object (i.e., intransitive verbs like rain in It rained). Second, there are copulative verbs (also called linking verbs) such as be and seem, which link the subject to a modifier in the predicate (e.g., He seems old). In addition to these two types of main verbs there are also auxiliary verbs (do, be, have, may, should, etc.) which are used in combination with main verbs to indicate various tenses, voices, and syntactic structures. For example, the auxiliary do is used in the formation of both negative sentences and questions through the rule of do-support, which inserts the proper form of do in structures of these types (e.g., Do you like wheaties? I don't like them).

Related Research

Little systematic research has been reported on the development of the verb system in young hearing children, probably because the verb system is one of the most complex parts of the English language. Brown (1973) reports that in his studies, the verb first appeared in Stage I (mean utterance length (mlu) of 1.75 to 2.25 morphemes) in its generic, unmarked form and was interpreted by parents as either an imperative, a past, an expression of an intention, or a progressive expression of temporary duration. This generic form was modified, after Stage I, in three ways: as a primitive progressive (with-ing but no auxiliary), as past (with -d or an irregular allomorph), or as a generic verb with such catenatives as gonna, wanna, or hafta. Cazden (1968) found that tense markers were acquired before the use of the axuiliary, and that the present progressive, which was first used correctly between Stages II (2.25 - 2.75 morphemes mlu) and III (2.75 - 3.5 morphemes mlu), preceded the regular past and the present indicative, which were not used correctly until Stage V (4.00 plus morphemes mlu) or later.

Previous research by Quigley (1969) on the written language of deaf children revealed that there were four aspects of the verb system which were particulary difficult for the deaf children in his study to master. These involved the use of auxiliary verbs, the use of tense markers, and the use of copulas, as well as the tendency of deaf children to omit the verb from the sentence.

Perhaps the most frequent of all errors encountered in the analysis of deaf children's written language were those having to do with the system of verbal auxiliaries, particularly incorrect pairing of auxiliaries with verb markers (e.g., *was pushing by*, *has pushing*). Verbal auxiliaries are crucial to a number of basic functions in English. They are used frequently with the present progressive tense (The boy *is* kicking the ball), the perfective aspect (The man *has* opened the door), and the passive voice (The ball *was kicked by* the boy). However, these are not the only functions of auxiliary verbs. When negating a sentence, the negative element is generally contracted with the first auxiliary verb (Fish *can't* play baseball), or (if there is no auxiliary present) *do* is inserted before the negative by a rule of *do-support* (The man *didn't* see a lion). When forming a question the auxiliary verb and the subject are inverted (*Can* all the boys run?). If there is no auxiliary in the sentence, *do* is added and placed before the subject (*Did* the children play in the park?).

In research with young hearing children, Bellugi (1967) reported that the development of the auxiliary verb system occurs quite rapidly and dramatically during Stage III. When the auxiliary appears during this period it is used in its full uncontracted form (I will go home) rather than in its contracted from (I'll go home), despite the fact that the child generally hears the contracted form in the speech of others. Allen (1971) found that the auxiliaries which occur with the progressive were mastered earlier than those occurring with the perfective. She also reported that the modal auxiliaries (*can*, *will*, *may*, *might*, etc.) were not mastered as a class, but as specific items or subclasses of vocabulary that were learned in terms of the child's continuing need to subject them to more and more complex transformations such as those used in negation and question formation.

Quigley's (1969) analysis of written language revealed that deaf students also have great difficulty in marking tense. This was particularly true for conjoined structures, where students frequently marked the tense of the first verb and left the second unmarked (e.g., Bill *threw* the ball and Jean *catch* it). Marking verbs for tense and aspect (e.g., progressive or perfective) is required under certain circumstances, and this also causes difficulty for deaf children.

Deaf children also tended to delete verbs in some environments in their written language. This was particularly true of sentences containing a locative phrase, where it may be that some deaf children use the preposition to function as a verb (e.g., The cat *under* the table). In addition, verb deletion occurred with *be* and *have* in sentences like *John a ball* or *The girl sick*. Verb deletion is rare in Standard English. Only in certain constructions like *The boy bought some apples and the girl some oranges*, (where the second occurrence of *bought* does not appear) can the verb be appropriately deleted. However, the copula does not exist at all in some languages such as Hungarian and Hebrew, and in Russian the copula is not used in the present tense. Since the copula has no semantic content, it has been suggested (Jacobs and Rosenbaum, 1968) that it may not exist in the deep conceptual structure of the sentences, but might instead be the result of an insertion transformation. Deletion of be, then, might more properly be described as a failure to insert it. Have, however, along with other verbs, is generally considered to be present in the deep structure.

Studies of the acquisition of language by young hearing children (Brown, Bloom, 1970) have reported that one of the three basic patterns that children produce is a N + N sequence with the verb omitted: for example, Mommy sock, in the situation where Mommy is putting on the child's sock. Bloom (1970) found that sentences used by children 18 to 24 months old usually do not have a copula, but that after two years it regularly appears.

In addition to the problem of the omission of be and have in sentences, deaf children's written language showed confusion in appropriate choice of be or have. The students tended to use a form of the verb have when the verb be was the correct choice. It is possible that this confusion arises because both be and have are used as auxiliaries marking tense and aspect and thus function similarly, and deaf children are not aware of subtle distinctions.

Results

Data for the four areas of the verb system discusssed here have been drawn from the Verbal Auxiliaries subtest, the Conjunction Sequencing subtest, and the Verb Deletion subtest of the TSA. Additional information on verbs was also available from the subtests on Negation and Question Formation. All of the subtests used in this analysis were of the "right-wrong-rewrite" format, where students were asked to make a judgment of grammaticality about each stimulus sentence; in addition, for half of the sentences presented, they were also asked to rewrite the sentence if it was judged wrong. Additional data on verbs were derived from the written compositions which the students were asked to produce. Multivariate analysis of variance was used to determine the significance of age differences for each subtest and for each of the item subgroupings.

Auxiliary Verbs

Tense and voice. When asked to judge the grammaticality or ungrammaticality of correct and incorrect sentences which contained auxiliary verbs in present progressives (The boy is kicking the ball), perfectives (The man has opened the door), and passives (The ball was kicked by the boy) deaf students across all age groups were correct in their judgments of present progressives 61% of the time, correct in judgments of perfectives 59% of the time, and correct in judgments of passives 56% of the time, F (2,455 = 4.67 $p < .01$. (See Table 30). The three structures interacted significantly with age, F (8,455) = 3.19, $p < .001$.

Hearing students also showed significant differences, F (2,57) = 17.13, $p < .001$, among the three verb types, although there was no significant interaction with age. The order of difficulty was the same as for the deaf students with present progressive verbs being judged correctly 84% of the time, perfectives 78% of the time, and passives 70% of the time.

Errors in the use of the auxiliary. Students were presented with sentences with auxiliaries missing, verb endings missing, or *by* missing (for the passive voice), as well as sentences which contained complete, correct auxiliary verbs and correct endings. There were significant differences among the results for the four types of sentences, F (3,455) = 68.11, $p < .001$. Correct sentences were judged "right" approximately 72% of the time by deaf students. Sentences with a missing auxiliary verb (The door opened by the man) were the most difficult for the deaf students to judge; they correctly judged such sentences ungrammatical only 45% of the time. Sentences with missing verb endings (The boy has kick the ball) were somewhat less difficult to judge (54% correct) and sentences with *by* missing (The ball was kicked the boy) were the least difficult (60% correct) of the error types.

There was also a significant interaction of the four sentence types with age, F (8,455) = 1.86, $p < .01$. The percent of correct judgments of grammatical sentences (72% correct) across all ages did not vary significantly across age; there was no improvement in ability to judge the sentences as grammatical as the students got older. (This also suggests that the increase in scores found in the analysis of tense and voice was due primarily to recognition of ungrammatical sentences as incorrect.) In contrast to the judgments of correct sentences, the deaf students improved steadily with age in their ability to judge deviant sentences (see Table 30).

The hearing students also showed significant differences, F (3,57) = 16.59, $p < .001$, in their ability to judge the four sentence types. Grammatical sentences were judged correctly 94% of the time and this did not change significantly with age. Sentences with auxiliary verbs missing were judged correctly (as ungrammatical) 72% of the time averaged across all ages. Sentences with verb endings missing (65% correct) and sentences with *by* missing (66% correct) were approximately equal in difficulty averaged across all ages.

A missing cell analysis of variance was performed to examine the interaction of verb type and error type. All three verb types

Table 30

Percent Correct Scores for Auxiliary Verbs

			Hearing students			Deaf students								
			Age			Age								
	# items	r	8	9	10	10	11	12	13	14	15	16	17	18
Tense and voice														
Progressive tense	5	.679	78	80	96	46	45	50	57	64	61	68	78	77
Perfective tense	4	.178	73	69	91	59	50	58	52	59	62	60	64	67
Passive voice	8	.404	66	66	78	52	51	51	52	56	58	63	64	61
Deviancies														
Missing auxiliary	4	.499	58	68	90	38	30	32	40	44	48	53	60	58
Missing verb ending	6	.755	60	54	82	41	38	46	47	59	55	57	68	72
Missing by	2	.618	75	60	63	53	54	51	57	54	65	73	67	69
Correct sentences	6	.546	91	94	97	70	72	74	68	72	72	76	76	70

(progressive, passive, and perfective) were included, but only missing auxiliaries and missing verb endings were included in the error types, along with grammatically correct sentences. The analysis for the deaf students revealed a significant interaction of verb type with error type, F (3,57) = 8.75, $p < .001$. As can be seen in Figure 37, grammatical sentences were the least difficult to judge across all verb types, with correct judgments of grammatical sentences being easiest for the progressive tense, passives being intermediate in difficulty, and perfectives being the most difficult. For sentences with verb endings missing (which were intermediate in difficulty overall), the progressive and the passive were equally difficult and were less difficult than the perfective. Sentences with the auxiliary missing were the most difficult to judge, and within this error type, progressives were less difficult than passives. (Perfectives were not included because without an auxiliary they sometimes merge with grammatical simple past sentences.)

Hearing students also displayed a significant interaction of verb type and error type, F (3,456) = 14.83, $p < .001$. Correct sentences were the least difficult for them to judge, and were equally easy for all three verb types. Sentences with the auxiliary verb missing were approximately equal in difficulty, with judgments of grammaticality a little better than 70% correct. A significant interaction between missing auxiliaries and missing verb endings was due primarily to the difficulty of judgments of grammaticality when the verb ending was missing. Judgments of missing verb endings were good for the progressive tense, but quite poor for both the passive and the perfective.

Tense Sequencing

When deaf students were asked to judge the grammaticality of conjoined sentences in which the verb tense had been correctly marked on the first verb, but not the second (Yesterday a boy *pushed* Mary and she *cry*); only on the second verb (Next Saturday the boys *wash* the car and father *will pay* them); or on both verbs (The lady *is sewing* and the man *is reading* a book) the results indicated that grammatical sentences ($\bar{X}$ = 86% correct) were significantly, F (2,1804) = 659.98, $p < .001$, easier to judge than sentences with only the first verb marked ($\bar{X}$ = 39% correct). Verb marked (first, second, or both) interacted with age, F (16,1804 = 1.65, $p < .05$, (see Table 31).

Hearing students also found sentences with both verbs correctly marked to be the least difficult ($\bar{X}$ = 96% correct). However, sentences with only the first verb marked ($\bar{X}$ = 65% correct) were less difficult than those with only the second verb marked ($\bar{X}$ = 44% correct), F (2,228) = 108.09, $p < .001$. Verb marked also interacted with age for hearing students, F (4,228) = 4.34, $p < .01$.

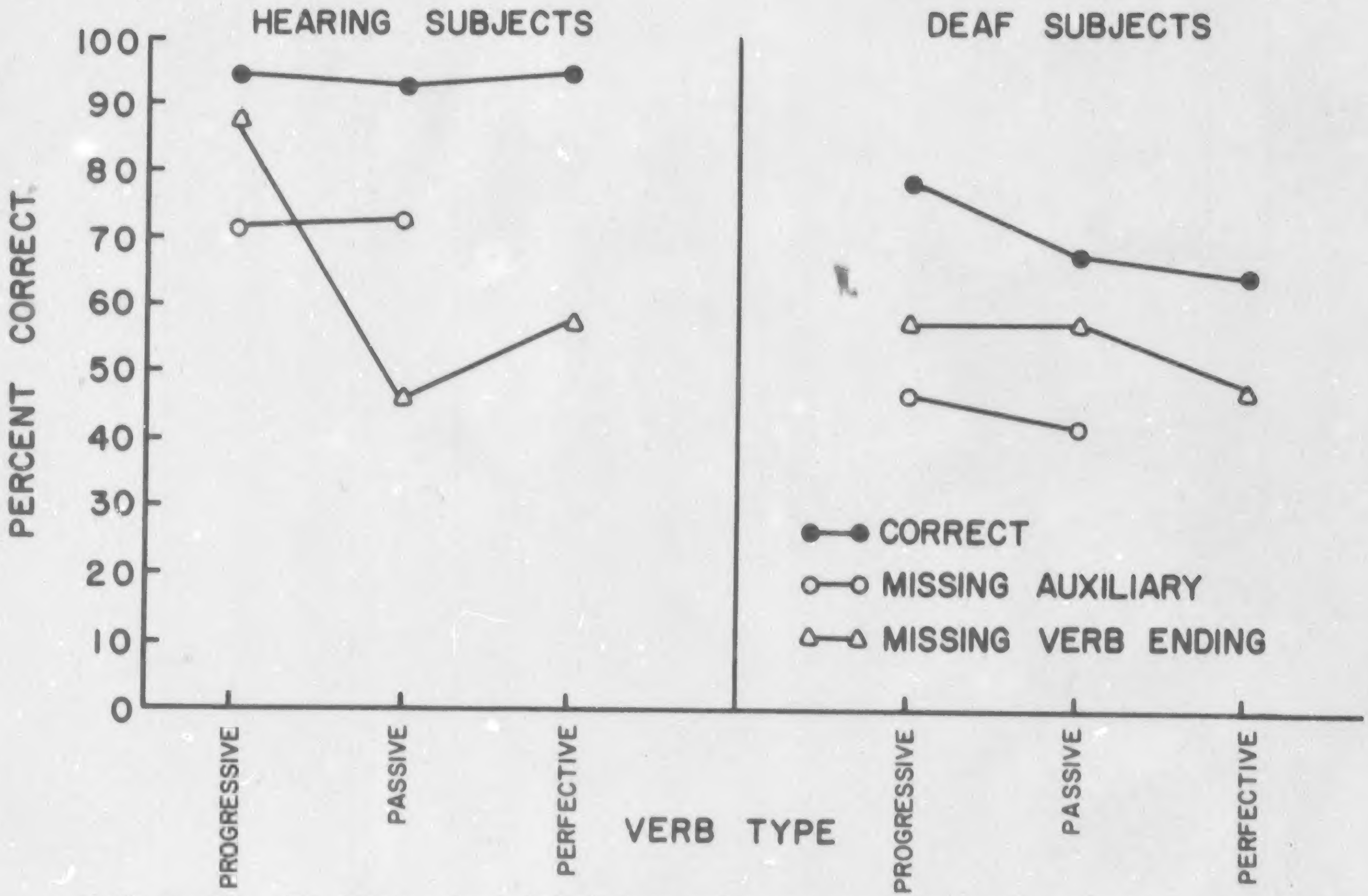


Figure 37. The interaction of verb type and error type for auxiliary verbs

Table 31

Percent Correct Scores for Tense Sequencing

			Hearing students			Deaf students								
			Age			Age								
	# items	r	8	9	10	10	11	12	13	14	15	16	17	18
Verb marked														
First	6	.470	67	53	76	28	26	31	37	40	36	49	52	50
Second	6	.445	38	33	62	32	28	32	37	37	41	42	53	50
Both	12	.465	95	97	95	78	84	85	85	86	83	91	89	91
Tense														
Past tense	8	.496	64	57	67	46	46	53	50	55	54	63	68	66
Future tense	8	.496	72	67	86	45	46	48	55	54	51	60	69	62
Progressive tense	8	.390	64	58	79	46	45	48	54	53	52	59	56	62

The tense of the verbs involved also made a difference, $F(2,1804) = 4.18$, $p < .05$. The past tense ($\bar{X} = 56\%$ correct) was the least difficult, followed by the future tense ($\bar{X} = 55\%$ correct), with the present progressive ($\bar{X} = 53\%$ correct) being the most difficult. However, tense interacted significantly with verb marked, $F(4,1804) = 9.44$, $p < .001$, as can be seen in Figure 38.

Hearing children also showed significant, $F(2,228) = 9.91$, $p < .001$, differences in the difficulty levels of the tenses. For them, however, the future tense ($\bar{X} = 75\%$ correct) was the least difficult, followed by the present progressive ($\bar{X} = 67\%$ correct), with the past tense being the most difficult ($\bar{X} = 63\%$ correct). Tense also interacted with verb marked, $F(4,228) = 5.28$, $p < .001$.

Verb Deletion

The verb deletion subtest assessed the deaf students' ability to recognize that the main verb had been deleted in one of two environments: intransitive sentences with the linear structure subject-verb-prepositional phrase (*The cat* (hid) *under the chair*) and transitive sentences of the form subject-verb-object-prepositional phrase (*The boy* (threw) *the ball over the fence*). The intransitive ($\bar{X} = 80\%$ correct) environment was significantly, $F(3,1337) = 16.27$, $p < .001$, more difficult than the transitive environment ($\bar{X} = 84\%$ correct). For both environments there was a significant increase in performance with age, as can be seen in Table 32. Hearing students did not show any significant differences between the two environments in which the main verb was deleted.

Be - Have Confusion

One additional area in which deaf children have trouble with written language is in the proper use of the verbs *be* and *have*. Deletion of *be* and *have* as well as the substitution of *be* for *have* and vice versa were tested. (Information on these problems comes from the *Verbal Auxiliaries* subtest and the *Verb Deletion* subtest.) Sentences of the structure subject-*be*-predicate adjective were presented with or without *be* deleted (*The girl* (is) *sick*). Deaf students' performance improved significantly with increasing age, as can be seen in Table 33, $F(8,455) = 14.34$, $p < .001$. Other items tested deletion of *have* in the environment subject-*have*-object (*The man* (has) *a hat*). Again there was a significant, $F(8,455) = 11.68$, $p < .001$, improvement with increasing age for the deaf students, which can be seen in Table 33. Across all ages, judgments were more accurate in the subject-*be*-predicate adjective environment ($\bar{X} = 85\%$ correct) than in the subject-*have*-object environment ($\bar{X} = 81\%$ correct). This difference was statistically significant, $F(3,1377) = 16.27$, $p < .001$. Hearing students had little difficulty with either

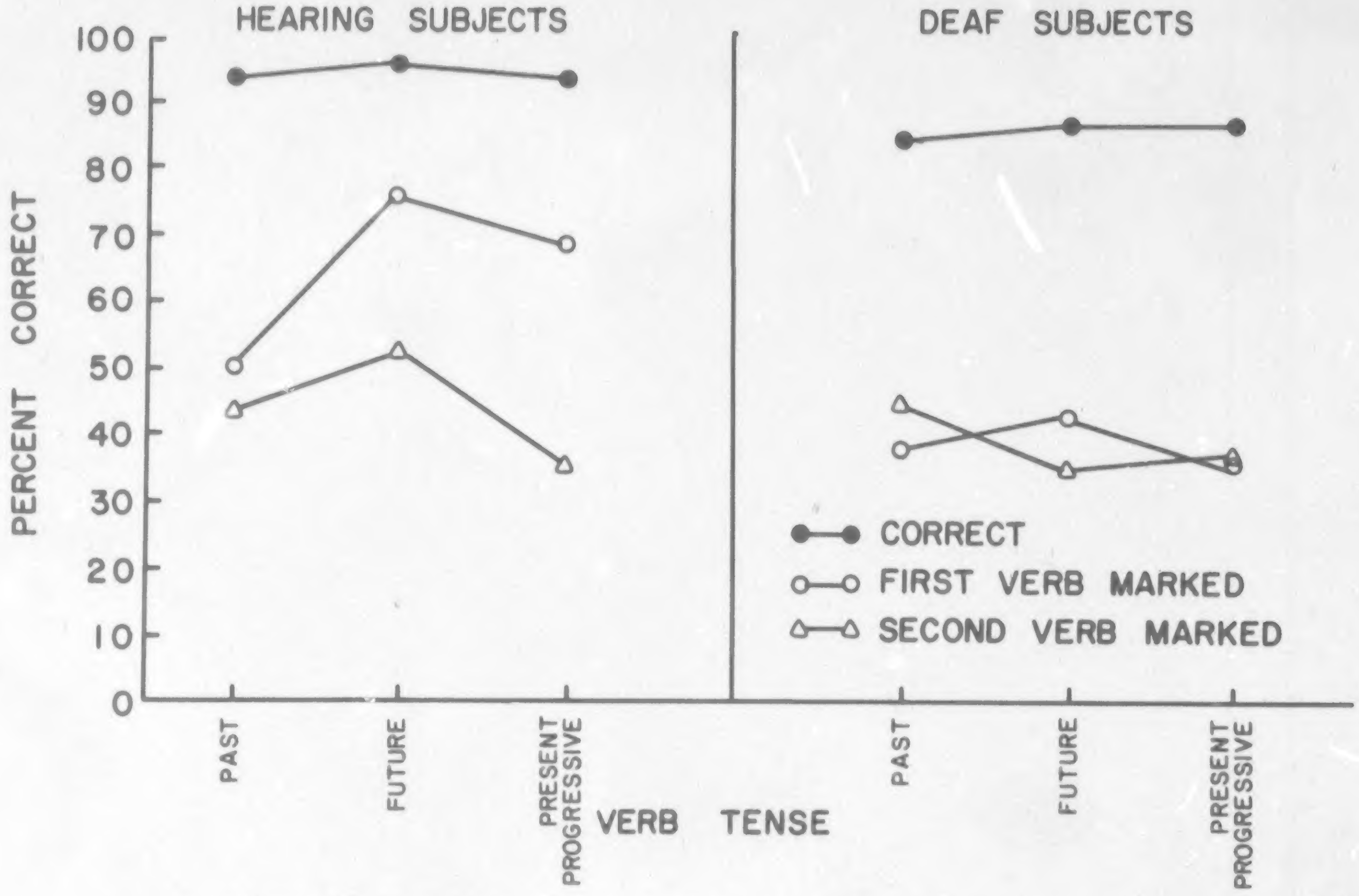


Figure 38. The interaction of verb marked with verb tense

Table 32

Percent Correct Scores for Verb Deletion

			Hearing students			Deaf students								
			Age			Age								
	# items	r	8	9	10	10	11	12	13	14	15	16	17	18
Subject-verb-prepositional phrase	4	.471	86	93	100	61	66	75	85	83	81	89	88	89
Subject-verb-object-prepositional phrase	4	.474	95	99	99	66	73	78	85	86	89	93	94	93

Table 33

Percent Correct Scores for Be and Have

			Hearing students			Deaf students								
			Age			Age								
	# items	r	8	9	10	10	11	12	13	14	15	16	17	18
Deletion														
Subject-be-predicate adjective	4	.535	95	95	99	62	78	80	84	90	91	93	94	93
Subject-have-object	4	.707	87	96	100	58	68	71	83	87	83	90	93	93
Confusion														
be for have	2	.741	65	55	57	26	39	37	37	42	44	57	57	60
have for be	2	.721	85	75	90	38	45	41	44	48	50	65	75	80
Correct	4	.685	93	99	100	71	83	89	86	87	86	92	86	85

environment, with an average of 96% correct for the subject-be-predicate adjective environment and an average of 95% correct for the subject-have-object environment.

Students were also asked to judge sentences in which be had been incorrectly substituted for have (The man is a coat), sentences in which have had been incorrectly substituted for be (The baby has happy), and grammatical sentences in which the correct verb had been used. Across all ages, correct grammaticality judgments were greatest for grammatical sentences (86% correct), and have substituted for be was detected as an error (54% correct) more frequently than the substitution of be for have (44% correct), $F\ (2,455) = 182.73$, $p < .001$.

The interaction with age was significant, $F\ (8,455) = 2.37$, $p < .01$. As can be seen in Figure 39, when presented with correct sentences containing either be or have, deaf students were correct in their grammaticality judgments 71% of the time at age 10, with an increase to 85% at age 18, $F\ (8,455) = 2.70$, $p < .05$. When have was substituted for be, correct judgments were only 38% at age 10, although they increased to 80% by age 18, $F\ (8,455) = 6.78$, $p < .001$. The students had even more difficulty with be substituted for have, with only 26% correct judgments at age 10 and increasing to only 60% at age 18, $F\ (8,455) = 3.62$, $p < .001$. Hearing students displayed the same order of difficulty, but their grammatical judgments were much better. Grammatical sentences were correctly judged 97% of the time, have for be 83%, and be for have 59%, $F\ (2,57) = 25.61$, $p < .001$.

Written Language Sample

The relative order of difficulty for the structures under consideration was seen to be the same in the production data of the written language sample as for the grammaticality judgments of the TSA. That is, present progressives were easiest, followed by perfectives and then passives, the least used of the three.

Progressive tense was very common in the writing of the deaf students, with 407 instances produced by 148 of the 469 students (32%). Usage increased with age, with 4 deaf students producing progressives at age 10, and 22 (out of 50) using them at age 18. Progressives were produced by 63% of the hearing sample, with 8 students out of 20 using them at age 8, and 15 of 20 using them at both ages 9 and 10.

Perfectives were seldom used, with only 25 occurrences; they were produced by only 22 deaf students, 5% of the total. One student at age 10, 6 at 17, and 3 at 18 each produced one perfective. For the hearing sample, perfective structures were produced by only 6 students out of 60 (10%), with a total of only 7 occurrences.

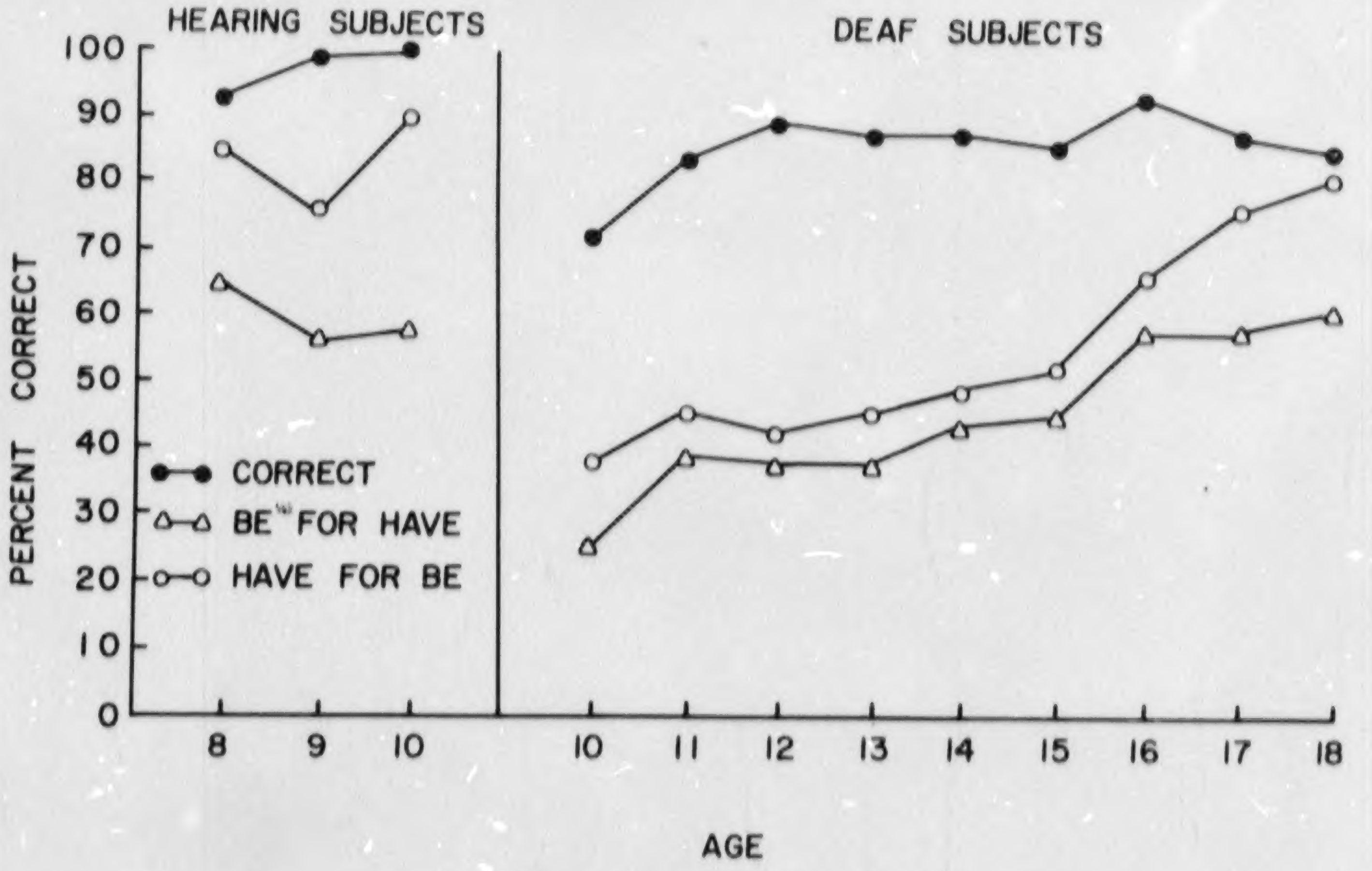


Figure 39. Acceptance of be for have and have for be

Passive sentences were even less common, with only 11 uses of be passives by 10 deaf students (2% of the total). Five deaf students (8%) each used one got passive. Neither type of passive appeared at all before age 14. Only 2 of the 60 hearing students (3%) each produced one be passive, and 5 hearing students (8%) each used a got passive.

Auxiliaries were incorrectly deleted just 43 times by 30 deaf students (6%), while no such "errors" were made by any hearing students.

Discussion

Deaf students have considerable difficulty with the verb system of English. This difficulty is particuarly pronounced in three of the four problem areas reported here (auxiliary verbs, tense sequencing, and be vs. have, but not verb deletion).

The rules for the use of auxiliary verbs are not well established in the language of deaf students, especially when compared to their development in young hearing children. The results from the analysis of present progressives, perfectives, and passives demonstrated the poor performance of deaf students, particularly in relationship to tense and voice.

Deaf students also had considerable difficulty with the sequencing of tense in a sentence. Although they were able to recognize correct sequences as correct, their judgments of grammaticality for incorrect sentences (those having only one verb marked for tense) were below chance for the younger ages and at chance for the oldest. This indicates that the deaf students are confused about whether or not both verbs need to be marked for tense.

In the data for verbal auxiliaries and tense sequencing, there appeared to be a developmental ordering in the use of the structural verb types by deaf students. Tense sequencing judgments were easiest for the past tense, followed by the future tense, with the present progressive being the most difficult. In the verbal auxiliaries subtest, judgments were correct at a younger age for progressives than for perfectives, a finding similar to that reported by Allen (1971) with young hearing children. The passive was the most difficult, a finding which is supported by the work of Power and Quigley (1973).

Although the two subtests looked at quite different things, it is possible to tentatively combine their results to obtain the following rough order of acquisition: 1) simple past (e.g., Yesterday a man threw a ball), 2) future (e.g., Next week mother will make a cake), 3) present progressive (e.g., The girl is reading a book), 4) perfective (e.g., The man has opened the door),

5) passive (e.g., The ball was kicked by the boy). This increasing order of difficulty mirrors the formal and cognitive complexity of these five structural types (see Slobin, 1971). Type (1) differs from (2) - (5) in exemplifying inflection-suffixation only at the end of the verb (whereas (2) - (5) all contain preverbal auxiliaries). Slobin (1971) has claimed that the ends of words are more perceptually salient and that postword markers are learned earlier than preword markers. In addition, he argues that interrupted linguistic units (as in (3) - (5) --is...ing, has... -ed...was...-ed) are learned later than uninterrupted ones (as in (1) - (2)). Finally, (5) is not only extremely complex formally, requiring a verbal suffix, an auxiliary, an inserted by, and the exchange of subject and object, but it is also complex perceptually, because of the permutation of subject and object and resultant failure to preserve the underlying (deep) structure of the sentence. A possible explanation for (3) being learned before (4) involves the development of cognitive distinctions; the conceptually simpler present and immediate past are commonly learned before more complex tenses such as perfective (Brown, 1973; Cromer, 1968).

Order of difficulty for the hearing sample was similar, except that for them the past tense was more difficult than either the future tense or present progressive. This disagrees with Slobin's findings, and no explanation can be offered here.

Closely related to the developmental ordering suggested above was the extreme difficulty that deaf students had with verb agreement. The results from the verb deletion subtest indicated that deaf students generally recognized the need for a verb, but were, in general, unable to supply one that was correct in either number or tense.

The confusion of be and have, while not unique to deaf students, did appear to be much more of a problem for them than it was for hearing students. When either be or have was deleted from the sentence, deaf students were generally able to recognize that it was missing. They were able to correctly restore a form of be in such sentences more frequently than they were able to restore a form of have. However, their judgments of sentences where be had been incorrectly substituted for have or have for be were very poor. Thus, it appeared that if either of the two morphemes existed in a sentence, deaf students tended to accept it as correct, even if it was not.

Finally, it seems that in judging the grammaticality of sentences, improvement came not from recognizing correct sentences as correct, but rather from correctly identifying incorrect sentences as ungrammatical. The results from the subtests of verbal auxiliaries, tense sequencing, and be vs. have all support this hypothesis. In addition, the same pattern was also found in the study of complements (see chapter 7) and in the investigation of relativization (copying) (chapter 5).

In the Reading for Meaning series, (McKee, et al, 1966), progressives appeared in 3 out of 100 sentences in reader 1-2, increasing to 7 uses per 100 sentences in reader six. Perfectives appeared in 1 out of 100 sentences in reader 1-1, increased to 8 uses per 100 in the third grade reader, and then slowly decreased. Passives did not appear until the second reader, occurring here twice per 100 sentences and increasing to 5 uses per 100 at the sixth grade level. Although the number of occurrences are not particularly high, considering the great difficulty deaf students have with auxiliary verbs, even this is probably too many unless teaching of those structures is improved. Particularly revealing is the observation that nearly all instances of the passive appearing in the series were of the agent deleted type, which previous research has shown to be particularly difficult for deaf students (see Power and Quigley, 1973).

CHAPTER 12

SUMMARY OF THE FINDINGS

At the beginning of this investigation four major questions were posed.

1. What is the order of difficulty of various syntactic structures for deaf children; is it similar to the order of difficulty for hearing children; and is it predictable from transformational generative grammar?

2. How well established are the syntactic rules of Standard English in the language of deaf children at age levels from 10 through 18 years?

3. Are there developmental stages for these rules in deaf children, and, if so, how similar are they to developmental stages for hearing children?

4. Do deaf persons acquire the same syntactic rules as hearing persons, but at a retarded rate; or do they acquire some rules that never operate in the grammar of hearing persons?

A fifth question developed during the course of the investigation:

5. How does deaf children's understanding of various syntactic structures compare to the occurrence of those structures in their reading materials?

Data on Question 1 are presented in Table 34. The order of difficulty of the various syntactic structures was similar, though not identical, for both deaf and hearing children in the sample, with negation (76% correct), conjunction (73% correct), and question formation (66% correct) being the least difficult structures for deaf children, and the same structures, question formation (98% correct), conjunction (92% correct), and negation (90% correct) being the three least difficult structures for hearing children. That these three structures should be the least difficult of those studied is predictable from transformational generative grammar; they involve fewer transformations from deep structure to surface structure than the others. (McNeill, 1970)

For deaf children, more difficult structures were pronominalization (60% correct), the verb system (58% correct), complementation (55% correct), and relativization (54% correct). Hearing children also found this group of structures more difficult than question formation, conjunction, and negation, although the order for them was pronominalization (90% correct), complementation (88% correct), relativization (82% correct), and verbs (79% correct). Transformational generative grammar would predict that the recursive processes of relativization and complementation

Table 34

Summary of Performance on Syntactic Structures

Structure	Deaf students Average across ages	Age 10	Age 18	Increase	Hearing students Average across ages	Age 8	Age 10	Increase
Negation								
be	79%	60%	86%	26%	92%	89%	95%	6%
do	71	53	82	29	93	89	97	8
have	74	57	78	21	86	81	90	9
Modals	78	58	87	29	90	87	92	5
Means	76	57	83	26	90	86	93	7
Conjunction								
Conjunction	72%	56%	86%	30%	92%	88%	95%	7%
Deletion	74	59	86	27	94	91	97	6
Means	73	57	86	29	92	89	96	7
Question Formation								
Wh-questions:								
Comprehension	66%	44%	80%	36%	98%	97%	98%	1%
Yes/no questions:								
Comprehension	74	48	90	42	99	98	100	2
Tag questions	57	46	63	17	98	97	100	3
Means	66	46	78	32	98	97	100	3

Table 34 (continued)

Structure	Deaf students				Hearing students			
	Average across ages	Age 10	Age 18	Increase	Average across ages	Age 8	Age 10	Increase
Pronominalization								
Personal pronouns	67%	51%	88%	37%	78%	73%	83%	10%
Backward pronominalization	70	49	85	36	94	92	95	3
Possessive adjectives	65	42	82	40	98	99	98	-1
Possessive pronouns	48	34	64	30	99	99	99	0
Reflexivization	50	21	73	52	80	73	87	14
Means	60	39	78	39	90	87	92	5
Verbs								
Verb auxiliaries	54%	52%	71%	19%	81%	75%	87%	12%
Tense sequencing	63	54	72	18	78	74	82	8
Means	58	53	71	18	79	74	84	10
Complementation								
Infinitives and gerunds	55%	50%	63%	13%	88%	87%	88%	1%

Table 34 (continued)

Structure	Deaf students Average across ages	Age 10	Age 18	Increase	Hearing students Average across ages	Age 8	Age 10	Increase
Relativization								
Processing	68%	59%	76%	17%	78%	74%	83%	9%
Embedding	53	51	59	8	84	79	88	9
Relative pronoun referents	42	27	56	29	82	77	88	11
Means	54	46	63	18	82	77	86	9
Disjunction and Alternation	36%	22%	59%	37%	84%	81%	87%	6%

would be difficult for deaf children, partly because of the number of transformations involved and partly because of departure from the Subject-Verb-Object (S-V-O) surface order which deaf students tend to impose on sentences. Verbs are difficult for deaf and hearing children because of the inherent difficulty of the verbal auxiliary. Deaf children's scores on verbs were further depressed by their difficulty with passive voice which not only contains the auxiliary but also requires a departure from the Subject-Verb-Object (S-V-O) surface order for correct interpretation.

Deaf students found the disjunction and alternation tests to be the most difficult (36% correct), while hearing students (84% correct) had much less difficulty with them. This great difficulty for deaf students seems to be best explained by the complex semantic nature of sentences containing these structures.

It would seem from Table 34, then, that the order of difficulty for deaf students of the syntactic structures studied is what would be predicted from the theory of transformational generative grammar. The order is also similar to that for the hearing subjects, but it will be noted that differences among the mean scores on the structures for hearing subjects were often small and should be accepted only tentatively. The tests, while being sensitive to differences among deaf students are too gross for even 8-year-old hearing subjects.

In addition to providing mean scores for each syntactic structure for the deaf and the hearing students, Table 34 provides mean scores for each specific test for the youngest and oldest age groups of both types of subjects and the percentage increase in those scores. This will enable the teacher and clinician to determine what specific aspects of the larger structures present most difficulty for deaf children. For example, mean scores for deaf students on the embedding test in the relativization structure increased from only 51% at age 10 to only 59% at age 18, only 8% improvement in approximately 8 years. This was obviously a very difficult test for the deaf students and also provided an interesting example of the deaf students' tendency to force a Subject-Verb-Object (S-V-O) pattern on sentences, even where it is inappropriate. Given a sentence such as, The boy who hit the girl ran away, a deaf student is quite likely to believe that it was the girl who ran away. A similar strong tendency for surface reading of passive voice sentences was reported by Power and Quigley (1973) where deaf children were shown to interpret sentences such as, The girl was pushed by the boy, as The girl pushed the boy, changing passive to active voice and in the process, of course, completely changing the meaning of the original sentence. This surface reading of sentences we attribute to the simplistically structured nature of much of the language teaching for deaf children, and to the lack of widespread use of good language development techniques with deaf children during the first few critical years of life when language structure develops rapidly for hearing children.

Question 2, which concerned how well the syntactic rules of Standard English are established in the language of deaf children at age levels from 10 through 18 years, has been addressed at length in the various chapters of this report that deal with specific syntactic structures, and is treated also in Table 34. It can be seen there that most of the structures were not at all well established, even among the 18-year-old deaf students. Only simple transformations such as negation, question formation, and conjunction had been mastered to any signficant degree, and even those by no means completely so. In contrast, 10-year-old hearing students had mastered all but a couple of the most difficult structures, and problems with those were confined to relatively few children. It should be stressed again that the value of these data lie not in showing there is a large gap between deaf and hearing children, but in showing precisely where the problems are for deaf children as evidenced by their performances on the specific tests and by the particular deviant (from Standard English) structures they use, as will be discussed for Question 4.

Psycholinguistic studies (see McNeill, 1970) have shown that individual syntactic structures, such as negation, progress through developmental stages rather than emerging in the hearing child in full blown adult form. Question 3 asked if deaf children go through the same stages. This question can be answered only tentatively from the data of the present investigation, because we were dealing in the TSA mostly with the degree of difficulty of structures rather than with their emergence in the language of young children. Furthermore, it could reasonably be argued that since the deaf subjects ranged in age from 10 through 18 years, their language was more a product of formal teaching than of environmental development. A further problem in comparing the development of the same syntactic structure in deaf and hearing children is that only a few structures, e.g. negatio and question formation, have been examined in much detail for hearing children, and even those with only a few children. The literature of psycholinguistics is infinitely vaster than the data on which it is based.

With these cautions in mind, we still are willing to draw the tentative conclusion that syntactic structures develop similarly for deaf children as for hearing children, but at a greatly retarded rate. An exhaustive review of the psycholinguistic literature yielded at least one study (although often only one and that with only one or a very few subjects) of most of the syntactic structures we studied. Findings from those studies were compared with findings for deaf subjects in the present investigation with the TSA and the written language samples. Development within structures was found to be similar for deaf and hearing children for relativization, conjunction, complementation, question formation, pronominalization, negation, and the verb system. Furthermore, the order of development in many cases was what would be expected on the basis of transformational generative grammar. Thus, the similarities in development within structures and in order of difficulty of structures (Question 1) for deaf and hearing children seem to be greater than the differences, except for the rate of development. An important exception to this general rule was the presence in the language (both in comprehension and production) of many deaf subjects of certain distinct syntactic structures that rarely or never appeared in the language of the hearing subjects. This was the subject of Question 4.

We have already commented on the strong tendency of the deaf subjects to impose a Subject-Verb-Object (S-V-O) pattern on sentences, even sentences where this order does not apply, such as in the passive voice and some forms of relativization. This was coupled with a related tendency to connect the nearest noun phrase (NP) and verb phrase (VP) which led to misinterpretation of many sentences such as embedded relatives. These two factors, which suggest that the deaf subjects were perceiving English as a linear rather than an hierarchical structure, probably account for a large part of the deaf child's difficulty with the English language. These, along with other syntactic processes which seem to be peculiar to deaf children, are listed in Table 35. These are structures, apparentaly rule ordered, that appeared consistently and persistently in the language comprehension and production of many of the deaf subjects of the present investigation, but rarely or never in the hearing subjects. Thus, while the language of the deaf subjects appeared to develop along much the same lines as that of hearing children, although at a greatly retarded rate, deaf subjects often had in addition to their developing English structure a number of rule generated structures not found in English. These have been discussed in detail in various chapters of the report where it was pointed out that other investigators (Taylor, 1969) have also reported on similar phenomena.

The preceeding four questions guided the development of the investigation, but as the research progressed an important fifth question emerged. How does the deaf child's understanding of various syntactic structures compare to the occurrence of those structures in the materials he is expected to read and from which he is expected to learn? The important implications of this question will be discussed in the next chapter. We present here

Table 35

Some Distinct Syntactic Constructions in the Language of Deaf Students

Structural environment in which construction occurs	Description of construction	Example sentences
Verb system	Verb deletion	The cat under the table.
	Be or *have* deletion	John sick. The girl a ball.
	Be-*have* confusion	Jim have sick.
	Incorrect pairing of auxiliary with verb markers	Tom has pushing the wagon.
	By deletion (passive voice)	The boy was pushed the girl.
Negation	Negative outside the sentence	Beth made candy no.
Conjunction	Marking only first verb	Beth threw the ball and Jean catch it.
	Conjunction deletion	Joe bought ate the apple.
Complementation	Extra *for*	For to play baseball is fun.
	Extra *to* in POSS-ing complement	John goes to fishing.
	Infinitive in place of gerund	John goes to fish.
	Incorrectly inflected infinitive	Bill liked to played baseball.
	Unmarked infinitive without *to*	Jim wanted go.
Relativization	NP's where whose is required	I helped the boy's mother was sick.
	Copying of referent	John saw the boy who the boy kicked the ball.
Question formation	Copying	Who a boy gave you a ball?
	Failure to apply subject-auxiliary inversion	Who the baby did love?
	Incorrect inversion	Who TV watched?

Table 35 (continued)

Structural environment in which construction occurs	Description of construction	Example sentences
Question formation, Negation	Overgeneralization of contraction rule	I amn't tired. Bill willn't go.
Relativization, Conjunction	Object-object deletion	John chased the girl and he scared. (John chased the girl. He scared the girl.)
	Object-subject deletion	The dog chased the girl had on a red dress. (The dog chased the girl. The girl had on a red dress.)
All types of sentences	Forced subject-verb-object pattern	The boy pushed the girl. (The boy was pushed by the girl.)

a brief summary of the problem and of the findings discussed in detail in the various previous chapters of the report that deal with individual syntactic structures. The Appendix of this report summarizes the results of the linguistic analysis of the Reading for Meaning series (McKee, et al, 1966) which provided data for a response to Question 5.

As shown in detail in previous chapters, the gap between the deaf subjects' knowledge of specific syntactic structures and the appearance of those structures in the widely used Reading for Meaning series (McKee, et al, 1966) was so great for almost every structure, even for the 18-year-old subjects, that we feel justified in concluding that most deaf students cannot read the books which they are supposed to be reading and from which they are supposed to be learning. The important fact is not that there is a large gap but precisely what the gap is for each specific structure studied. When agent deleted passives appear in primers and first grade texts used by deaf students, and when data have shown that only 30% of 18-year-old deaf students understand that structure, a problem of major proportions obviously exists. Implications of this will be discussed in the next, and final, chapter of the report.

To summarize the results of the research lead to the conclusion that the structure of language as used by deaf students differed from that of hearing students primarily by being greatly retarded in development rather than by being different in kind. Deaf students gradually acquire knowledge of English syntax as they grow older, even though they still have little functional command of it by the time they finish formal schooling at the secondary level. While there are distinct structures in the language usage of deaf students which appear to be generated by rules peculiar to those students, such as object-object deletion and object-subject deletion, the similarities of their language to English structure are greater than the differences. The research did show that there is widespread use of certain distinct syntactic structures by deaf children and youth, but none of those structures was common to all subjects and most were used by fewer than 50%. However, the importance of the several distinct structures that were found should not be minimized. They do form, to an extent, a linguistic system different from English, which the teacher and the clinician must take into account in teaching language to deaf children. These structures tended, in considerable numbers to persist over time and to resist extinction.

Not to be minimized, either, is the vast extent of the difference in language development between deaf and hearing children. Most of the oldest deaf students in the study (between 18 and 19 years of age) did not have syntactic development equal to the 8-year-old hearing children. While this retarded development of deaf children in language structure as compared to hearing children will not suprise anyone who has worked with deaf children, its extent might. However, of greater importance than the general lack of syntactic knowledge are the data on the extent to which deaf students have mastered (or failed to master) specific English syntactic structures at various age levels. Related to this are the data on the frequency of occurrence of common English syntactic structures in reading materials used by deaf students and the great disparity between those data and the data on deaf students' knowledge at various age levels of the same structures.

CHAPTER 13

IMPLICATIONS OF THE FINDINGS

Four specific contributions of the research program are: (1) a method (the Test of Syntactic Ability) of assessing the development of syntactic structures in the language of deaf children; (2) the identification of distinct syntactic structures in the language of deaf persons generated by rules that are not part of English grammar; (3) a body of knowledge on the extent to which deaf students have mastered certain common but important English syntactic structures at various age levels; and (4) a body of knowledge on the frequency and level of occurrence of the same structures in commonly used reading materials. Each of these has important implications for teaching language to deaf children.

The Test of Syntactic Ability enables one to determine just how much mastery a deaf child (who is beyond the beginning reading stage) has of a particular syntactic structure. This provides the diagnostic information needed to plan specific development or remediation for each structure. The TSA also provides a general picture of a deaf child's knowledge of English structure, a means of comparing his performance with that of other children or with normative data, and a means of measuring changes in performance. Since developing functional use of syntax is one of the greatest problems in educating deaf children, it is surprising that other instruments have not been developed for diagnostic assessment of syntax, but such is the case. The TSA in its present form is, of course, not a very practical instrument. It was developed for research rather than clinical use and so such factors as time and ease of administration and scoring were of little consequence. The instrument is presently being developed into a clinical tool, however, with a multiple choice format and other features which will make it practical for clinical and classroom use in diagnosis and remediation of syntactic problems of deaf individuals.

The list of distinct syntactic structures in the language of deaf persons summarized in Table 35 should be a valuable aid to the teacher of deaf children. While the written language of such children seems to be a tangled web of syntax to a native speaker of English, there actually is structure in that tangled web; the words are not thrown randomly together. Part of the structure is English, or attempted approximations to English and some of it is generated by rules that are not part of English grammar. We say "generated by rules" because the distinct structures were too consistent and persistent in the written language of too many deaf children in the study to be merely idiosyncratic features. Some of the structures listed in Table 35 were confined to particular language environments, such as use of NP's in place of whose in relativization; others occurred in more than one environment, such as object-object and object-subject deletion in relativization and conjunction; and the S-V-O pattern extensively imposed by deaf children on sentences appeared to affect all types of sentences. It is possible that knowledge of these structures will enable the teacher to attempt remediation of the underlying rules rather than considering each syntactic "deviation" as a distinct problem to be treated separately from all others.

The body of knowledge concerning deaf children's mastery (or lack of it) of specific structures at various age levels will enable teachers to construct language materials that are appropriate to the child's knowledge of syntax. It should also make apparent, when considered along with the information on the frequency and level of occurrence of those structures in commonly used reading materials, that syntax is a major factor to be considered in modifying reading materials or developing new ones specifically for deaf children. This implication for reading and reading materials is important enough to warrant development in some detail.

Reading and Reading Materials

Although the use of various methods of communication in educating deaf children is the subject of much controversy, there is general agreement that deaf children in our society need to learn to read and write the English language. But this goal is rarely achieved. Deaf students rarely exceed the fifth grade reading level on standard tests by the time they leave school; studies using "cloze" procedures (Moores, 1967) have shown that the standard tests actually give spuriously high estimates of the reading ability of deaf children; and the present research clearly establishes that many, probably most, 18-year-old deaf students lack the knowledge of syntactic structures (such as agent-deleted passives) that is needed to read a fourth grade textbook or the front page of a newspaper. More importantly, they are likely to actually misread such materials, since reading the active for the passive voice and connecting the closest NP's and VP's in sentences with embedded relative clauses changes the meaning of the sentences. So we have failed to achieve the minimal goals of literacy for deaf children -- the ability to read and write the English language at a functional level.

A similar, although much less severe, situation exists in teaching the reading and writing of Standard English to children who speak nonstandard dialects. Wolfram and Fasold (1974) describe the problem as resulting from a mismatch between the dialect the child brings to the reading process (for example, Vernacular Black English) and the language of the materials used in teaching reading (generally Standard English). In dealing with the learning to read problem of children with nonstandard dialects, sociolinguistic studies have suggested a number of approaches which fall into two broad categories: (a) modification of reading materials to match the language the child brings to the reading process; and (b) modification of the language of the child to match the reading materials. The findings of the present research indicate the need for similar approaches to the reading process with deaf children.

Modification of Materials

Two main methods have been proposed in this approach for children with nonstandard dialects: (a) the use of dialect readers; and (b) the neutralization of dialect differences in the readers. For example, dialect readers have been written using Vernacular Black English (Davis, Gladney, and Leaverton, 1969). Similar to these two approaches have been the development of reading books for deaf children (Croker, Pratt, and Jones, 1966) and the language materials developed by Project LIFE (1970). But while materials developed for children with nonstandard dialects have been based on substantial sociolinguistic research, those developed for deaf students have been based on clinical or teaching intuitions and experience. One contribution of the present research is to supply a body of data about the development of syntactic structures in deaf children that can serve to guide the development of materials that more closely match the language of the child than those now available.

In the case of deaf children, however, the mismatch between the Standard English of common reading materials and the child's language is usually so great that modifying reading materials or even developing new ones probably has limited value. Comparison of the data on the degree of mastery of various syntactic structures by deaf students with the data on the frequency of occurrence of the same structures in the *Reading for Meaning* series (McKee, et al, 1966) shows the disparity for all but a few of the structures to be so great that modification of materials seems not to be practical. The development of new materials based on the research data and data from other studies (e.g., Taylor, 1969; O'Neill, 1973) seems to offer more hope. Even this approach, however, will have limited success, unless there is a greater approximation to Standard English than now exists in the language the deaf child brings to the reading process. This leads to the second major approach suggested by sociolinguistic research (see Wolfram and Fasold) which is to modify the language of the child prior to learning to read so that it approximates Standard English as closely as possible.

Modification of the Child's Language

Most deaf children reach school age with language that varies from relatively good Standard English in oral or manual form to almost no language at all. Only a very few will have the command of Standard English required for the reading process, and so the teacher must either teach the necessary Standard English in some form or start by teaching reading as the initial form of language. Early language teaching for deaf children in the classroom almost always involves reading. So, rather than developing a language base on which reading can be superimposed, as is the case with hearing children, reading itself is being used as the means for teaching reading. The extremely limited success that has resulted from these methods is painfully obvious and indicates that other approaches are needed. One approach would be to develop Standard English during infancy and early childhood, and only later develop reading on that language base.

The need to establish language during infancy and early childhood has long been recognized by teachers of deaf children. The problem has been how best to accomplish that task. During the past decade increasing research has been devoted to the problem, and as part of the present research program a study was conducted (Brasel and Quigley, 1975) to determine if early childhood intervention could foster good English language development in deaf children and which of several possible types of intervention might be most successful.

Table 36 shows the study design. Four groups of deaf subjects between the ages of 10 years and 18 years, 11 months were tested with the Test of Syntactic Ability (TSA) and language and reading subtests of the Stanford Achievement Tests (SAT). The groups, 18 subjects in each, were dichotomized according to whether the parents were hearing or deaf. The deaf parents all used some form of Sign Language; this group was again divided, depending on the type of signs utilized by the parents. Similarly, the hearing parents, all of whom used spoken English in communicating to their children, were divided according to the amount and intensity of oral preschool training (and implementation at home) provided by the parents. The Manual English group had deaf parents who had a good command of English, as determined by samples of their written language, and who used Manual English with the subjects from infancy in the same manner that hearing parents would use oral communication with their hearing children. What was called the Average Manual group had deaf parents whose written language showed gross deviations from Standard English and who used manual communication, probably some form of Ameslan (American Sign Language), with the subjects from infancy. The Intensive Oral group had highly educated hearing parents who sought and received formal training on using oral methods with their children, and used them exclusively and intensively in the home to supplement school and clinic training. Deaf children in the Average Oral group had parents who received no formal training in oral methodology and did not attempt any special training of children before enrolling them in school; still, only oral communication was used in the home.

Table 36

The Study Design (N = 72)

	Manual Groups		Oral Groups		
Chronological Age	Manual English	Average Manual	Intensive Oral	Average Oral	Total
10.0-12.11	3 m, 3 f	3 m, 3 f	3 m, 3 f	3 m, 3 f	12 m, 12 f
13.0-15.11	3 m, 3 f	3 m, 3 f	3 m, 3 f	3 m, 3 f	12 m, 12 f
16.0-18.11	3 m, 3 f	3 m, 3 f	3 m, 3 f	3 m, 3 f	12 m, 12 f
Total	9 m, 9 f	9 m, 9 f	9 m, 9 f	9 m, 9 f	36 m, 36 f
	(n = 18)	(n = 18)	(n = 18)	(n = 18)	

Note. From "The influence of early language and communication environments on the development of language in deaf children" by K. E. Brasel and S. P. Quigley, Urbana, Ill.: Institute for Research on Exceptional Children, 1975. Reprinted by permission.

It was hypothesized that deaf parents would have easier and more fluent conversational interaction with their deaf children through manual communication than would the hearing parents with their deaf children through oral communication. It was also hypothesized that the deaf children of deaf parents using Standard English in manual communication form (the Manual English [ME] group) would acquire better command of the English structure, as measured by the TSA, than would the deaf children of deaf parents using American Sign Language (the Average Manual [AM] group), which in turn would be superior to the group of deaf children with parents who used intensive oral methods (the Intensive Oral [IO] group), which in turn would have superior language structure in comparsion to the group of deaf children with hearing parents who employed no specific procedures with their deaf children (the Average Oral [AO] group). It was further hypothesized that the differences on the TSA would be paralleled by differences on the reading and language subtests of the SAT (Stanford Achievement Tests). In summary, for the TSA and the SAT

ME > AM > IO > AO

Table 37 shows descriptive data for subjects and parents in the four groups. The average age of the subjects at the time of the study was identical in the four groups, 13.8 years. The performance test IQ's were similar for the groups except for that of the Average Oral group as compared to the Manual English group. The small differences in IQ were controlled statistically in making comparisons of performance on the SAT and the TSA. Deafness was confirmed somewhat earlier for the children of deaf parents than for those of hearing parents. Children in the Intensive Oral group began formal schooling much earlier than children in the other three groups, and the parents of the children in that group also had a much higher socioeconomic status (SES) level than the parents of children in the other groups. We have then, four groups of equal age and approximately equal IQ, with one group (IO) having parents of high socioeconomic level who used oral methods of communication intensively with their children from infancy and provided formal schooling for them by the age of 2 years; another group (ME) having deaf parents of above average socioeconomic level who used Manual English with their children from infancy and did not have them in school until 4½ years of age; a third group (AO) having hearing parents who simply used oral communication in the home without any special training; and a fourth group (AM) having deaf parents with limited command of English who used various forms of Ameslan with their children from infancy. It was assumed that any differences that were evident among the groups on the Test of Syntactic Ability and the language subtests of the Stanford Achievement Test could be attributed mostly to the different forms of communication and types of language the children were exposed to in the language formative years.

Table 38 summarizes the results for the groups on the Test of Syntactic Ability and Figure 40 presents the same data graphically. The Manual English group had scores on relativization and verb usage of around 80% and scores on conjunction, negation, and question formation of about 90%. This high performance on tests measuring various syntactic structures was supported by their good performance in written language, examination of which revealed few of the deviations common to the written language of deaf children as reported in other chapters. The differences between the Manual English and the Intensive Oral group were statistically significant on all but one of the six tests of syntax. The performance of the Intensive Oral and Average Manual groups was quite similar on all six tests, and performance of the Average Oral group was considerably lower than any of the others on all six tests.

Table 37

Descriptive Data, Subjects and Parents, by Group
(N = 72, 36 male and 36 female subjects)

Descriptive Item	Manual English n = 18	Average Manual n = 18	Intensive Oral n = 18	Average Oral n = 18
Mean Age	14.8	14.8	14.8	14.8
PIQ[a]	121	114	119	107
Age deafness confirmed	0.58 yr.	0.39 yr.	1.19 yr.	1.23 yr.
Age began schooling[b]	55.8 mo.	50.7 mo.	23.9 mo.	50.5 mo.
SES factor of parents[c]	1.14	-2.02	2.63	-1.61

[a] Difference in PIQ was significant ($p > .05$) only between the ME and the AO groups.

[b] Differences between the two Oral groups are the result of the selection process. (No control was exerted over the two manual groups in Age began schooling.)

[c] Intensive Oral group was significantly higher in SES than the other three groups ($p > .001$).

Note. From "The influence of early language and communication environments on the development of language in deaf children" by K. E. Brasel and S. P. Quigley, Urbana, Ill.: Institute for Research on Exceptional Children, 1975. Reprinted by permission.

Table 38

Test of Syntactic Ability, Mean Percentage Scores, Ranges and Standard Deviations, by Group and Structure (N = 72)

Group	Relativization	Question Formation	Negation	Conjunction	Verb Usage	Pronominalization
ME						
Mean %	80.87	89.8	91.9	87.5	82.2	89.9
Range %	50.8-95.2	59.2-99.3	82.9-100.0	36.3-98.8	65.8-94.7	56.7-99.3
SD	11.94	11.36	4.86	15.80	8.86	9.54
IO						
Mean %	66.3	76.0	84.9	73.1	69.4	71.2
Range %	47.6-92.4	34.5-99.3	53.4-97.3	26.3-100.0	42.1-89.5	23.3-98.0
SD	13.29	19.74	12.30	21.23	14.34	23.07
AM						
Mean %	66.4	81.3	86.7	76.5	74.5	78.7
Range %	47.6-90.3	52.1-94.4	47.3-97.3	37.5-96.3	50.0-90.8	40.7-96.0
SD	13.56	15.31	12.41	16.79	11.39	19.07
AO						
Mean %	58.1	64.0	79.4	67.6	66.8	64.6
Range %	43.6-75.8	28.2-94.4	43.8-95.2	30.0-93.8	51.3-85.5	32.7-97.3
SD	8.53	18.63	15.29	15.84	10.71	19.31
Total						
Mean%	67.898	77.786	85.724	76.207	73.208	76.08
Range %	43.6-95.2	28.2-99.3	43.8-100.0	26.3-100.0	42.1-94.7	23.3-99.3
SD	11.12	13.63	10.32	16.16	10.83	15.42

Note. From "The influence of early language and communication environments on the development of language in deaf children" by K.E. Brasel and S. P. Quigley, Urbana, Ill.: Institute for Research on Exceptional Children, 1975. Reprinted by permission.

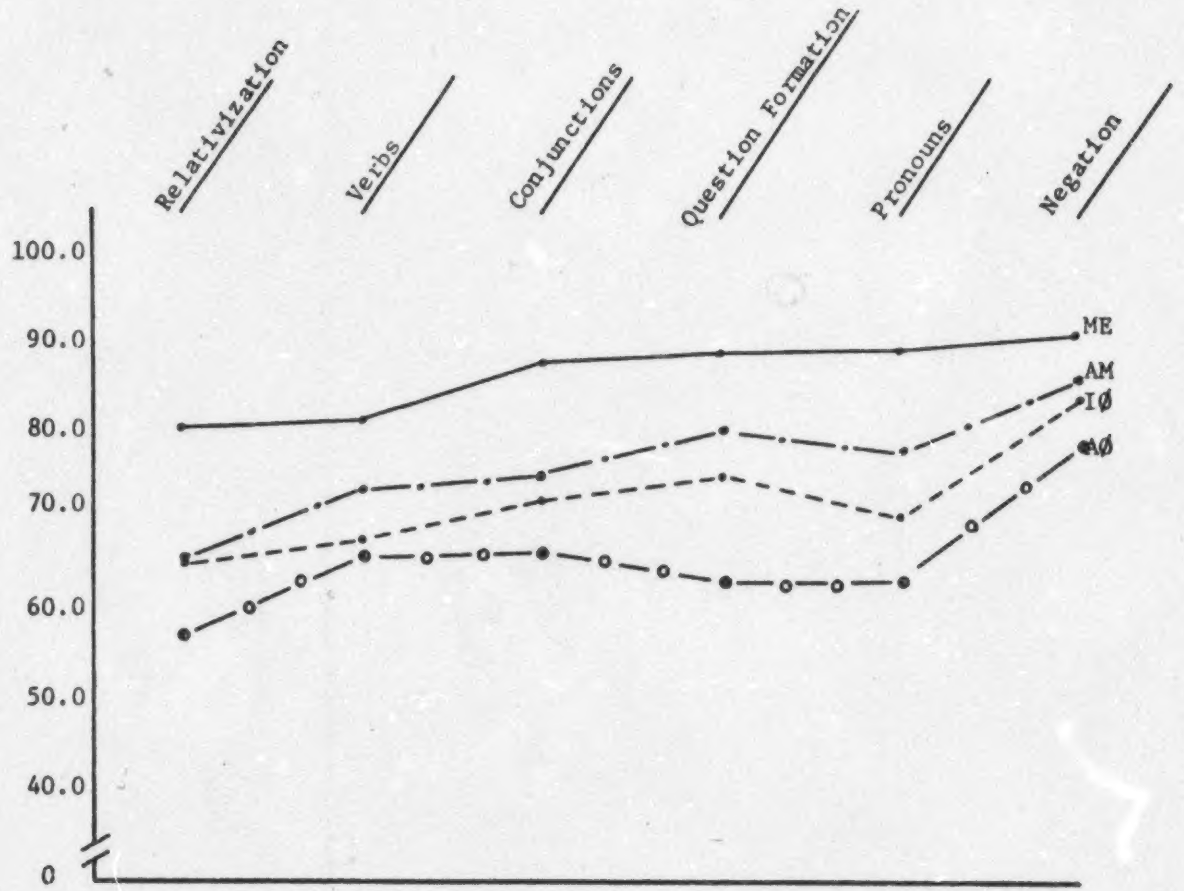


Figure 40. Means, all Six Main Structures, All Ages Combined

Note. From "The influence of early language and communication environments on the development of language in deaf children" by K. E. Brasel and S. P. Quigley, Urbana, Ill.: Institue for Research on Exceptional Children, 1975. Reprinted by permission.

On the Stanford Achievement Test, the Manual English group was significantly superior to the other three groups on all four subtests used: Paragraph Meaning, Word Meaning, Language, and Spelling. The results shown in Tables 39, 40, and 41 for Paragraph Meaning are illustrative. The ME group at 7.26 was more than two grade levels ahead of the IO and AM groups which had identical grade equivalents of 5.06, and almost three and a half grades ahead of the 3.88 grade equivalent of the AO group.

All of this indicates that the language system which the deaf child brings with him to school and to the beginning reading process depends largely on (a) the type of communication, and (b) the type of language to which he is exposed in the language formative years. The Brasel and Quigley results indicate the more visible the form of communication, the more easily the deaf child can receive it and respond to it, other things being reasonably equal. Thus, the children in the Manual English group far outperformed those in the Intensive Oral group, even though the socioeconomic status of the parents in the IO group was considerably higher than that of the parents in the ME group. Since both these groups of parents were using Standard English, the difference was in the form of communication, manual in one case and oral in the other. But, since the Manual English group also far outperformed the Average Manual group, who also used manual communication but in the form of Ameslan, the form of language used appears to be of major importance as well as the form of communication. If we accept being able to read and write adequately in Standard English as desirable objectives for deaf children, the Manual English used in the language formative years seems to be the best way to establish the language base on which reading and writing can be developed.

Even if we accept the idea that we must develop a Standard English language base in the deaf child during the language formative years by whatever is the best means, deaf children will still reach school, and the reading process, with language deficits in terms of Standard English. A brief review of the graph and tables from the Brasel and Quigley data will show that while the children in the Manual English group far outperformed those in the other three groups on the TSA and the SAT, their performance was still below what would be expected of hearing children of comparable age, intelligence, and socioeconomic background. This means a mismatch of some degree between the child's language system and that of extant reading materials. Teaching language and its read and written forms will still remain the teacher's chief task, at least through the elementary

Table 39

Stanford Achievement Test Means and Standard Deviations, All Groups (N = 68), Equal n's; Paragraph Meaning Sub-test

	Manual English	Average Manual	Intensive Oral	Average Oral
	n = 17	n = 17	n = 17	n = 17
$\bar{X}$ Age (in years)	15.0	15.0	15.1	14.9
$\bar{X}$ Grade equiv.	7.24	5.06	5.06	3.88
SD	2.27	1.8461	2.10	1.5363

Table 40

Analysis of Variance Using Equal n's, SAT Paragraph Meaning Sub-Test

Source of Variation	SS	df	MS	F	Prob.
Between groups	98.66	3	32.887	8.70	< .0001
Within groups	242.21	64	3.78		
Total	340.87	67			

Note. From "The influence of early language and communication environments on the development of language in deaf children" by K. E. Brasel and S. P. Quigley, Urbana, Ill.: Institute for Research on Exceptional Children, 1975. Reprinted by permission.

Table 41

Tukey Contrasts and Confidence Intervals, SAT Paragraph Meaning Sub-Test

	Conf. Interval	Prob.
ME - AM	(.23, 3.75)	< .05
ME - IO	(.42, 3.94)	< .05
ME - AO	(1.60, 5.12)	< .001
IO - AM	(-1.57, 1.95)	ns
IO - AO	(- .39, 3.13)	ns
AM - AO	(- .58, 2.94)	ns

Note. From "The influence of early language and communication environments on the development of language in deaf children" by K. E. Brasel and S. P. Quigley, Urbana, Ill.: Institute for Research on Exceptional Children, 1975. Reprinted by permission.

years. But if the deaf child reaches the stages of beginning reading with some reasonable command of Standard English, the teacher's task is simplified. She can then use the same procedures used in teaching reading to children with nonstandard dialects, neutralizing dialect differences in the reading materials or in some other manner adjusting the reading materials to the language level of the child. While the increasing number of linguistic studies of deaf children will eventually supply a fund of information which will undoubtedly be used as the basis for developing specialized language materials and curricula for deaf students, successful application of those materials and curricula will depend on the teacher's understanding of the linguistic principles on which they are based.

APPENDIX A

SUMMARY INFORMATION ON THE TEXT SERIES ANALYSIS AND A COMPARISON OF SENTENCES AND T-UNITS AS STANDARDIZING BASES

This paper briefly summarizes the results of the linguistic analysis of the Reading for Meaning (McKee, et al., 1966) reading textbook series of Houghton Mifflin Company.

Table A-1 gives the number of times each linguistic structure appeared in each of the eleven texts analyzed. The following texts were included in the analysis:

I: first primer
II: second primer
III: third primer
1-1: first first-grade reader
1-2: second first-grade reader
2-1: first second-grade reader
2-2: second second-grade reader
3-1: first third-grade reader
4: fourth-grade reader
5: fifth-grade reader
6: sixth-grade reader

An example of each of the structures included in the analysis appears on page .

* * *

The raw data appearing in Table A-1 does not allow one to make inter-book comparisons since the books are of varying length. (The last two lines of Table A-1 give the number of sentences and T-units appearing in each of the books.) In order to allow for inter-book comparisons, the data in Table A-1 was standardized to give the number of structures that appear per sentence and per T-unit. This information appears in Tables A-2 and A-3 respectively.

If one looks at the use of the structure "and" in the first primer, for example, he finds it occurred an average of .10 times for every sentence and .14 times for every T-unit (i.e., "and" occurred an average of 10 times every 100 sentences and 14 times every 100 T-units). A ".0" entry in these two tables does not necessarily mean that the structure never appeared in the given book, but that it appeared less frequently than once every 100 sentences (or T-units). Its rate of occurrence could, of course, be computed from the information contained in Table A-1.

* * *

Table A-1

Occurrence of Structures

Structure/Book	I	II	III	1-1	1-2	2-1	2-2	3-1	4	5	6
Sub Conj NP	2	-	2	7	31	50	55	88	219	264	241
Obj Conj NP	2	2	3	14	12	59	114	88	364	566	552
Conj VP	16	17	11	55	43	156	286	298	798	996	1065
and	18	17	15	105	96	245	424	790	1787	2544	2563
Conj S	-	-	-	18	63	135	135	266	534	772	871
then	-	-	-	13	15	1	6	2	23	15	29
but	-	-	-	19	24	47	50	102	206	253	285
so	-	-	-	6	1	1	2	1	16	24	33
Conj Adj	-	-	-	14	7	17	22	50	129	226	159
Conj Adv	-	-	-	-	8	18	31	67	94	188	225
VP-0 in Conj S	-	-	-	-	3	35	15	12	152	178	110
or	-	-	-	-	7	14	40	55	125	209	233
modals	38	89	128	342	233	429	537	803	1514	1985	1959
perfective	-	1	-	10	24	40	122	256	434	508	484
do-support	-	-	25	157	72	129	171	210	409	416	358
progressive	-	-	-	3	41	56	133	241	355	483	506
contracted modals	-	-	-	-	19	77	89	170	322	443	268
revers. pass no agent	-	-	-	-	-	12	5	14	41	73	90
revers. pass w/agt.	-	-	-	-	-	2	1	-	9	22	32
non-rev. pass no agt.	-	-	-	-	-	30	64	71	126	279	270
non-rev. pass w/agt.	-	-	-	-	-	3	1	2	22	48	44
got - pass	-	-	-	-	-	2	2	1	1	4	3
not in VP	23	34	47	158	104	225	278	390	715	856	708
neg. impera.	-	1	-	-	2	4	5	6	35	36	37
neg. adj.	-	-	2	7	10	18	20	36	64	130	204

Table A-1 (continued)

Structure/Book	I	II	III	1-1	1-2	2-1	2-2	3-1	4	5	6
neg. nouns	-	-	-	1	4	15	17	32	81	102	90
neg. adv.	-	-	-	-	24	19	23	32	75	87	137
pred. adv.	24	27	94	85	27	65	61	83	204	230	312
pred. nom.	-	33	14	119	16	115	158	273	547	664	687
pred. adj.	-	14	4	43	62	198	250	364	898	1124	1011
there-insertion	-	-	-	6	14	29	51	89	178	183	246
yes/no Q	10	8	26	114	90	87	96	115	163	225	258
direct Q	10	23	-	217	172	210	226	219	411	541	583
WH-Q	-	15	34	128	85	124	150	124	341	469	428
indirect Q	-	-	-	34	20	60	85	127	99	145	93
direct Imp.	67	73	36	152	82	167	120	168	405	436	505
Imp. w/you	6	7	3	-	-	2	3	-	22	36	26
poss. pron.	-	-	2	29	4	-	8	8	30	36	26
poss. adj.	-	-	-	54	68	51	205	382	1544	1993	1999
forward pron.	-	-	-	14	11	43	81	286	1385	1927	1677
backwards pron.	-	-	-	-	-	3	1	4	34	44	33
"of" - genitives	-	-	-	-	-	-	-	-	-	-	645
"s" - genitives	-	-	-	-	-	-	-	-	-	-	398
infinit. Rel Cl.	-	7	-	2	2	-	-	-	22	96	112
prep-fronted Rel.	-	7	-	2	3	11	10	11	53	90	87
Rel. pron. Ø	-	7	-	6	13	26	31	60	201	332	264
when, where, while	-	-	6	4	-	80	122	227	431	561	468
final Rel. Cl.	-	-	6	15	28	-	-	-	-	-	-
obj.-fronted Rel.	-	-	-	7	15	34	47	90	299	403	352
subj-fronted Rel.	-	-	-	1	3	26	62	129	283	455	550
Rel. Extra-position	-	-	-	2	-	10	4	20	57	41	29

Table A-1 (continued)

Structure/Book	I	II	III	1-1	1-2	2-1	2-2	3-1	4	5	6
WHIZ-0	-	-	-	-	6	7	32	65	543	596	752
Wh moved from Subord Cl.	-	-	-	-	1	3	-	1	4	13	1
Appositives	-	-	-	-	-	7	11	24	62	96	142
For-to, no subj.	-	11	2	79	93	190	338	477	1200	1395	1462
For-to, w/subj.	-	4	-	6	5	12	11	20	62	76	56
Subj-Raising	-	1	-	15	5	5	11	10	40	73	138
that	-	-	-	15	20	101	144	371	609	709	730
that deleted	-	-	-	-	-	-	-	-	-	-	215
Tough move.	-	-	-	-	2	5	13	10	9	-	3
Poss-ing, no subj.	-	-	-	-	-	7	48	92	310	597	761
Poss-ing, w/subj.	-	-	-	-	-	-	2	5	11	25	45
Adj. comp.	-	-	-	-	-	16	44	94	202	460	609
noun comp.	-	-	-	-	-	1	1	10	1218	1766	1636
Adv. Subord. Cl.	-	-	-	-	-	53	121	158	839	1201	1180
Extraposition	-	-	-	-	-	-	11	-	150	166	143
Wh-com	-	-	-	-	-	-	-	-	353	465	437
Indir. Quotes	-	-	-	5	-	-	-	-	-	-	-
Indir. Imp.	-	-	-	4	-	4	2	-	35	45	29
Dir. Quote/ Quest.	-	-	-	87	133	143	163	199	330	408	394
Dir. Quote/Imp.	-	-	-	144	84	144	102	121	281	313	296
Dir. Quote/S	-	-	-	676	675	815	775	1082	1723	2255	1902
Reflexives	-	-	-	-	3	7	26	37	102	180	162
Sentences	183	331	317	1395	1423	2202	2439	3371	5877	7448	7493
T-units	131	286	334	1413	1204	2473	2825	3672	6475	8038	7599

Table A-2

Structures Per Sentence

Structure/Book	I	II	III	1-1	1-2	2-1	2-2	3-1	4	5	6
Sub Conj NP	.01	.0	.01	.01	.02	.02	.02	.03	.04	.04	.03
Obj Conj Np	.01	.01	.01	.01	.01	.03	.05	.03	.06	.08	.07
Conj VP	.09	.05	.03	.04	.03	.07	.12	.09	.14	.13	.14
and	.10	.05	.05	.08	.07	.11	.17	.23	.30	.34	.34
Conj S	.0	.0	.0	.01	.04	.06	.06	.08	.09	.10	.12
then	.0	.0	.0	.01	.01	.0	.0	.0	.0	.0	.0
but	.0	.0	.0	.01	.02	.02	.02	.03	.04	.03	.04
so	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Conj Adj	.0	.0	.0	.01	.0	.01	.01	.01	.02	.03	.02
Conj Adv	.0	.0	.0	.0	.01	.01	.01	.02	.02	.03	.03
VP-0 in Conj S	.0	.0	.0	.0	.0	.02	.01	.0	.03	.02	.01
or	.0	.0	.0	.0	.0	.01	.02	.02	.02	.03	.03
Modals	.21	.27	.40	.25	.16	.19	.22	.24	.26	.27	.26
perfective	.0	.0	.0	.01	.02	.02	.05	.08	.07	.07	.06
do-support	.0	.0	.08	.11	.05	.06	.07	.06	.07	.06	.05
progressive	.0	.0	.0	.0	.03	.03	.05	.07	.06	.06	.07
contracted modals	.0	.0	.0	.0	.01	.03	.04	.05	.05	.06	.04
revers pass no agt	.0	.0	.0	.0	.0	.01	.0	.0	.01	.01	.01
revers pass w/agt	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
non-rev pass no agt	.0	.0	.0	.0	.0	.01	.03	.02	.02	.04	.04
non-rev pass w/agt	.0	.0	.0	.0	.0	.0	.0	.0	.0	.01	.01
got-pass	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Not in VP	.13	.10	.15	.11	.07	.10	.11	.12	.12	.11	.09
Neg Impera	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Neg adj	.0	.0	.01	.01	.01	.01	.01	.01	.01	.02	.03
Neg nouns	.0	.0	.0	.0	.0	.01	.01	.01	.01	.01	.01

Table A-2 (continued)

Structure/Book	I	II	III	1-1	1-2	2-1	2-2	3-1	4	5	6
Neg adv	.0	.0	.0	.0	.02	.01	.01	.01	.01	.01	.02
pred adv	.13	.08	.30	.06	.02	.03	.03	.02	.03	.03	.04
pred nom	.0	.10	.04	.09	.01	.05	.06	.08	.09	.09	.09
pred adj	.0	.04	.01	.03	.04	.09	.10	.11	.15	.15	.13
there-insertion	.0	.0	.0	.0	.01	.01	.02	.03	.03	.02	.03
yes/no Q	.05	.02	.08	.08	.06	.04	.04	.03	.03	.03	.03
direct Q	.05	.07	.0	.16	.12	.10	.09	.06	.07	.07	.08
Wh-Q	.0	.05	.11	.09	.06	.06	.06	.04	.06	.06	.06
indirect Q	.0	.0	.0	.02	.01	.03	.03	.04	.02	.02	.01
direct Imp	.37	.22	.11	.11	.06	.08	.05	.05	.07	.06	.07
Imp w/you	.03	.02	.01	.0	.0	.0	.0	.0	.0	.0	.0
poss pron	.0	.0	.01	.02	.0	.0	.0	.0	.01	.0	.0
poss adj	.0	.0	.0	.04	.05	.02	.08	.11	.26	.27	.27
forward pron	.0	.0	.0	.01	.01	.02	.03	.08	.24	.26	.22
backwards pron	.0	.0	.0	.0	.0	.0	.0	.0	.01	.01	.0
"of" genitives	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.09
"s" genitives	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.05
infinit Rel cl	.0	.02	.0	.0	.0	.0	.0	.0	.0	.01	.01
prep fronted Rel	.0	.02	.0	.0	.0	.0	.0	.0	.01	.01	.01
Rel pron Ø	.0	.02	.0	.0	.01	.01	.01	.02	.03	.04	.04
when, where, while	.0	.0	.02	.0	.0	.04	.05	.07	.07	.08	.06
final Rel Cl.	.0	.0	.02	.01	.02	.0	.0	.0	.0	.0	.0
Obj fronted Rel	.0	.0	.0	.01	.01	.02	.02	.03	.05	.05	.05
Subj fronted Rel	.0	.0	.0	.0	.0	.01	.03	.04	.05	.06	.07
Rel Extraposition	.0	.0	.0	.0	.0	.0	.0	.01	.01	.01	.0
WHIZ Ø	.0	.0	.0	.0	.0	.0	.01	.02	.09	.08	.10
Wh moved from subord cl	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

Table A-2 (continued)

Structure/Book	I	II	III	1-1	1-2	2-1	2-2	3-1	4	5	6
Appositives	.0	.0	.0	.0	.0	.0	.0	.01	.01	.01	.02
For-to no subj	.0	.03	.01	.06	.07	.09	.14	.14	.20	.19	.20
For-to w/subj	.0	.01	.0	.0	.0	.01	.0	.01	.01	.01	.01
Subj-raising	.0	.0	.0	.01	.0	.0	.0	.0	.01	.01	.02
that	.0	.0	.0	.01	.01	.05	.06	.11	.10	.10	.10
that deleted	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.03
tough move	.0	.0	.0	.0	.0	.0	.01	.0	.0	.0	.0
poss-ing no subj	.0	.0	.0	.0	.0	.0	.02	.03	.05	.08	.10
poss-ing w/subj	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.01
Adj comp	.0	.0	.0	.0	.0	.01	.02	.03	.03	.06	.08
noun comp	.0	.0	.0	.0	.0	.0	.0	.0	.21	.24	.22
Adv. subord Cl.	.0	.0	.0	.0	.0	.02	.05	.06	.14	.16	.16
Extraposition	.0	.0	.0	.0	.0	.0	.0	.0	.03	.02	.02
wh-comp	.0	.0	.0	.0	.0	.0	.0	.0	.06	.06	.06
Indir Quotes	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Indir Imp	.0	.0	.0	.0	.0	.0	.0	.0	.01	.01	.0
Dir Quote/Quest	.0	.0	.0	.06	.09	.06	.07	.06	.06	.05	.05
Dir Quote/Imp	.0	.0	.0	.10	.06	.07	.04	.04	.05	.04	.04
Dir Quote/S	.0	.0	.0	.48	.47	.37	.32	.32	.29	.30	.25
Reflexives	.0	.0	.0	.0	.0	.0	.01	.01	.02	.02	.02

Table A-3

Structures Per T-Unit

Structure/Book	I	II	III	1-1	1-2	2-1	2-2	3-1	4	5	6
Subj Conj NP	.02	.0	.01	.0	.03	.02	.02	.2	.03	.03	.03
Obj Conj NP	.02	.01	.01	.01	.01	.02	.04	.02	.06	.07	.07
Conj VP	.12	.06	.03	.04	.04	.06	.10	.08	.12	.12	.14
and	.14	.06	.04	.07	.08	.10	.15	.22	.28	.31	.34
Conj S	.0	.0	.0	.01	.05	.05	.05	.07	.08	.10	.11
then	.0	.0	.0	.01	.01	.0	.0	.0	.0	.0	.0
but	.0	.0	.0	.01	.02	.02	.02	.03	.03	.03	.04
so	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Conj Adj	.0	.0	.0	.01	.01	.01	.01	.01	.02	.03	.02
Conj Adv	.0	.0	.0	.0	.01	.01	.01	.02	.01	.02	.03
VP-0 in Conj S	.0	.0	.0	.0	.0	.01	.01	.0	.02	.02	.01
or	.0	.0	.0	.0	.01	.01	.01	.01	.02	.03	.03
modals	.29	.31	.38	.24	.19	.17	.19	.22	.23	.25	.26
perfective	.0	.0	.0	.01	.01	.01	.04	.07	.07	.06	.06
do-support	.0	.0	.07	.11	.06	.05	.06	.06	.06	.05	.05
progressive	.0	.0	.0	.0	.03	.02	.05	.07	.05	.06	.07
contracted modals	.0	.0	.0	.0	.02	.03	.03	.05	.05	.06	.04
revers pass no agt	.0	.0	.0	.0	.0	.0	.0	.0	.01	.01	.01
revers pass w/agt	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
non-rev pass no agt	.0	.0	.0	.0	.0	.01	.02	.02	.02	.03	.04
non-rev pass w/agt	.0	.0	.0	.0	.0	.0	.0	.0	.0	.01	.01
got-pass	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Not in VP	.18	.12	.14	.11	.09	.09	.10	.11	.11	.11	.09
Neg impera	.0	.0	.0	.0	.0	.0	.0	.0	.01	.0	.0
Neg adj	.0	.0	.01	.0	.01	.01	.01	.01	.01	.02	.03
Neg nouns	.0	.0	.0	.0	.0	.01	.01	.01	.01	.01	.01
Neg adv	.0	.0	.0	.0	.02	.01	.01	.01	.01	.01	.02

Table A-3 (continued)

Structure/Book	I	II	III	1-1	1-2	2-1	2-2	3-1	4	5	6
Pred adv	.18	.09	.28	.06	.02	.03	.02	.02	.03	.03	.04
Pred nom	.0	.12	.04	.08	.01	.05	.06	.07	.08	.08	.09
Pred adj	.0	.05	.01	.03	.05	.08	.09	.10	.14	.14	.13
there-insertion	.0	.0	.0	.0	.01	.01	.02	.02	.03	.02	.03
yes/no Q	.08	.03	.08	.08	.07	.04	.03	.03	.03	.03	.03
direct Q	.08	.08	.0	.15	.14	.08	.08	.06	.06	.07	.08
WH-Q	.0	.05	.10	.09	.07	.05	.05	.03	.05	.06	.06
indirect Q	.0	.0	.0	.02	.02	.02	.03	.03	.02	.02	.01
direct Imp	.51	.26	.11	.11	.07	.07	.04	.05	.06	.05	.07
Imp w/you	.05	.02	.01	.0	.0	.0	.0	.0	.0	.0	.0
poss pron	.0	.0	.01	.02	.0	.0	.0	.0	.0	.0	.0
poss adj	.0	.0	.0	.04	.06	.02	.07	.10	.24	.25	.26
forward pron	.0	.0	.0	.01	.01	.02	.03	.08	.21	.24	.22
backwards pron	.0	.0	.0	.0	.0	.0	.0	.0	.01	.01	.0
"of" genitives	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.08
"s" genitives	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.05
infinit Rel Cl	.0	.02	.0	.0	.0	.0	.0	.0	.0	.01	.01
prep fronted Rel	.0	.02	.0	.0	.0	.0	.0	.0	.01	.01	.01
Rel pron 0	.0	.02	.0	.0	.01	.01	.01	.02	.03	.04	.03
when, where, while	.0	.0	.02	.0	.0	.03	.04	.06	.07	.07	.06
final Rel Cl	.0	.0	.02	.01	.02	.0	.0	.0	.0	.0	.0
Obj fronted Rel	.0	.0	.0	.0	.01	.01	.02	.02	.05	.05	.05
Subj fronted Rel	.0	.0	.0	.0	.0	.01	.02	.04	.04	.06	.07
Rel Extra-position	.0	.0	.0	.0	.0	.0	.0	.01	.01	.01	.0
WHIZ 0	.0	.0	.0	.0	.0	.0	.01	.02	.08	.07	.10
WH moved from Subord Cl	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Appositives	.0	.0	.0	.0	.0	.0	.0	.01	.01	.01	.02

Table A-3 (continued)

Structure/Book	I	II	III	1-1	1-2	2-1	2-2	3-1	4	5	6
For-to no subj	.0	.04	.01	.06	.08	.08	.12	.13	.19	.17	.19
For-to w/subj	.0	.01	.0	.0	.0	.0	.0	.01	.01	.01	.01
Subj-raising	.0	.0	.0	.01	.0	.0	.0	.0	.01	.01	.02
that	.0	.0	.0	.01	.02	.04	.05	.10	.09	.09	.10
that deleted	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.03
tough move	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
poss-ing no subj.	.0	.0	.0	.0	.0	.0	.02	.03	.05	.07	.10
poss-ing w/subj.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.01
Adj comp	.0	.0	.0	.0	.0	.01	.02	.03	.03	.06	.08
noun comp	.0	.0	.0	.0	.0	.0	.0	.0	.18	.22	.22
Adv subord Cl	.0	.0	.0	.0	.0	.02	.04	.04	.13	.15	.16
Extraposition	.0	.0	.0	.0	.0	.0	.0	.0	.02	.02	.02
WH-comp	.0	.0	.0	.0	.0	.0	.0	.0	.05	.06	.06
Indir Quotes	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Indir Imp	.0	.0	.0	.0	.0	.0	.0	.0	.01	.01	.0
Dir Quote/ Quest	.0	.0	.0	.06	.11	.06	.06	.05	.05	.05	.05
Dir Quote/Imp	.0	.0	.0	.10	.07	.06	.04	.04	.04	.04	.04
Dir Quote/S	.0	.0	.0	.48	.56	.33	.27	.29	.27	.28	.25
Reflexives	.0	.0	.0	.0	.0	.0	.01	.01	.02	.02	.02

The respective entries in Tables A-2 and A-3 look very similar. Table A-4 illustrates this similarity more clearly by showing the difference in the values of Tables A-2 and A-3. (Due to rounding error, entries in Table A-4 are accurate plus or minus .01. Actually, all figures reported in Tables A-2, A-3, and A-4 were computed to more than 10 significant digits on a computer, but the results were rounded to two significant places for reporting here.)

It is apparent from Table A-4 that, at least for this text series, it generally makes little difference whether one records structures per sentence or structures per T-unit. For a few structures (e.g., "and", modals, etc.) it does make a slight difference. The average discrepancy for all structures was .000869, and the correlation between the number of sentences per book and the number of T-units per book was .99779. This further tends to indicate that, mathematically, it makes little difference whether one uses sentences or T-units as a basis for inter-book comparisons.

Table A-4

Discrepancies: Structures/Sentence - Structures/T-unit

Structure/Book	I	II	III	1-1	1-2	2-1	2-2	3-1	4	5	6
Sub Conj NP	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Obj Conj NP	.0	.0	.0	.0	.0	.0	.01	.0	.01	.01	.0
Conj NP	-.03	-.01	.0	.0	-.01	.01	.02	.01	.01	.01	.0
and	-.04	-.01	.0	.0	-.01	.01	.02	.02	.03	.03	.0
Conj S	.0	.0	.0	.0	-.01	.01	.01	.01	.01	.01	.0
then	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
but	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
so	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Con Adj	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Conj Adv	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
VP-0 in Conj S	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
or	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
modals	-.08	-.04	.02	.0	-.03	.02	.03	.02	.02	.02	.0
perfective	.0	.0	.0	.0	.0	.0	.01	.01	.01	.01	.0
do-support	.0	.0	.0	.0	-.01	.01	.01	.01	.01	.0	.0
Progressive	.0	.0	.0	.0	-.01	.0	.01	.01	.01	.0	.0
contracted modals	.0	.0	.0	.0	.0	.0	.0	.0	.01	.0	.0
revers pass no agt	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
revers pass w/agt	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
non-rev pass no agt	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
non-rev pass w/agt	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
got-pass	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
NOT in VP	-.05	-.02	.01	.0	-.01	.01	.02	.01	.01	.01	.0
neg impera	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
neg adj	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
neg nouns	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
neg adv	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

Table A-4 (continued)

Structure/Book	I	II	III	1-1	1-2	2-1	2-2	3-1	4	5	6
pred adv	-.05	-.01	.02	.0	.0	.0	.0	.0	.0	.0	.0
pred nom	.0	-.02	.0	.0	.0	.01	.01	.01	.01	.01	.0
pred adj	.0	-.01	.0	.0	-.01	.01	.01	.01	.01	.01	.0
there-insertion	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
yes/no Q	-.02	.0	.0	.0	-.01	.0	.01	.0	.0	.0	.0
direct Q	-.02	-.01	.0	.0	-.02	.01	.01	.01	.01	.01	.0
WH-Q	.0	-.01	.01	.0	-.01	.01	.01	.0	.01	.0	.0
indirect Q	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
direct Imp	-.15	-.03	.01	.0	-.01	.01	.01	.0	.01	.0	.0
Imp w/you	-.01	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
poss pron	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
poss adj	.0	.0	.0	.0	-.01	.0	.01	.01	.02	.02	.0
forward pron	.0	.0	.0	.0	.0	.0	.0	.01	.02	.02	.0
backwards pron	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
"of" genitives	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
"s" genitives	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
infinit Rel Cl	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
pred fronted Rel	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Rel pron 0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
when, where, while	.0	.0	.0	.0	.0	.0	.01	.01	.01	.01	.0
final Rel Cl	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Obj fronted Rel	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Subj fronted Rel	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Rel Extra-position	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
WHIZ-0	.0	.0	.0	.0	.0	.0	.0	.0	.01	.01	.0
Wh moved from subord Cl.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Appositives	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

Table A-4 (continued)

Structure/Book	I	II	III	1-1	1-2	2-1	2-2	3-1	4	5	6
For-to no subj	.0	-.01	.0	.0	-.01	.01	.02	.01	.02	.01	.0
For-to w/subj	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Subj-raising	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
that	.0	.0	.0	.0	.0	.01	.01	.01	.01	.01	.0
that deleted	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
tough move	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
poss-ing no subj	.0	.0	.0	.0	.0	.0	.0	.0	.0	.01	.0
poss-ing w/subj	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Adj comp	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
noun comp	.0	.0	.0	.0	.0	.0	.0	.0	.02	.02	.0
Adv subord Cl	.0	.0	.0	.0	.0	.0	.01	.0	.01	.01	.0
Extraposition	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Wh-comp	.0	.0	.0	.0	.0	.0	.0	.0	.01	.0	.0
Indir Quotes	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Indir Imp	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Dir Quote/ Quest	.0	.0	.0	.0	-.02	.01	.01	.0	.01	.0	.0
Dir Quote/Imp	.0	.0	.0	.0	-.01	.01	.01	.0	.0	.0	.0
Dir Quote/S	.0	.0	.0	.01	-.09	.04	.04	.03	.03	.02	.0
Reflexives	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

EXAMPLES OF STRUCTURES COUNTED IN READING BOOK ANALYSIS

Sub Conj NP	[John and Mary] ran home.
Obj Conj NP	John saw [the cat and the dog.]
Conj VP	John [ran and jumped.]
Conj S	[John played the guitar, and Mary sang folk songs.]
Conj Adj	John patted the [black and white] dog.
Conj Adv	The plane flew [smoothly and quietly.]
VP-Ø in Conj S	I talked to John, and Mary did too.
modals	any occurrence of words like would, should, must, will, etc.
perfective	They had done this before.
do-support	Do you like baseball? John does not like spinach.
progressive	John is playing ball this afternoon.
contracted modals	things like wouldn't, shouldn't, we'll, etc.
revers pass no agent	John was seen at the store.
revers pass w/agent	John was seen at the store by the clerk.
non-revers pass no agent	The horse had been carefully groomed.
non-revers pass w/agent	The horse had been groomed by its owner.
got-pass	One of the boys got punched in the eye.
not in VP	John [will not be] in the play.
neg imper	Don't touch that!
neg. adj.	There was no furniture in the room.
neg noun	Nobody was in the room.

neg adv	John never forgets to feed his dog.
pred adv	John [is here.]
pred nom	John's father [is a teacher.]
pred adj	The car [is blue.]
there-insertion	There is a big tree in our front yard.
yes/no Q	Are you going?
direct Q	any question except those marked under indirect.
WH-Q	Where are you going?
indirect Q	John asked where Mary was.
direct Imper	Get out!
Imper w/you	You get out!
pass pron	This book is mine.
poss adj	This is my book.
forward pron	John glanced at Spot and then looked at him again.
backwards pron	His aching head made it difficult for John to work.
infinit Rel Cl	This is a nice house to live in.
prep-fronted Rel	This is the house in which John lives.
Rel pron	That is the man we saw. (vs the man whom we saw.)
final Rel Cl	I saw the boy who hit Mary.
obj-fronted Rel	John read the book which the girl had bought.
subj-fronted Rel	John liked the girl who had bought the book.
Rel Extraposition	That is the same man over there whom we saw yesterday.
WHIZ-0	John called to the man in the yard (vs the man who was in the yard).
WH moved from subord Cl	This is the boy who John said that he saw yesterday.

Appositives	Mr. Frondike, the mailman, is Billy's friend.
for-to, no sub	He wanted to go.
for-to, w/subj	He wanted for John to go first.
subj-raising	They thought him to be intelligent.
that	They knew that he was intelligent.
that-0	They knew he was intelligent.
Tough move	This jar is hard to open.
Poss-ing, no subj	They looked forward to leaving.
Poss-ing, w/subj	They looked forward to John's leaving.
Adj. comp	He was happy to go.
Noun comp	John knew that no one was home.
Adv. Subord Cl	Before Bill knew what was happening, everyone had left.
Extraposition	It was strange that no one was home.
WH-Comp	Bill knew what they had done.
Indir Quotes	He said that it was 3 o'clock.
Indir. Imper	John said to go home.
Dir Quote/Quest	John asked, "May I go out?"
Dir Quote/Imp	Mother said, "Wear your boots!"
Dir Quote/S	John declared, "I don't want to wear them."
Reflexives	John saw himself reflected in the window.

APPENDIX B

Table B-1

	Pronominalization	Conjunction	Relativization	Negation	Question Formation	Verb System
Pronominalization	1.000	.715	.678	.760	.857	.808
Conjunction		1.000	.579	.633	.682	.671
Relativization			1.000	.502	.703	.673
Negation				1.000	.743	.712
Question Formation					1.000	.808
Verb System						1.000

Table B-2

Correlation of Structures with Demographic Data

	Age	Sex	Mother Deaf	Father Deaf	Years in School After 6	Years in School Before 6	Total Years in School	Number of deaf Siblings	Better ear Average	IQ	Hearing Aid Use	Age at Onset
Pronominalization	.553	.160	.195	.210	.569	.101	.567	.092	-.070	.372	.044	-.072
Conjunction	.410	.115	.114	.135	.420	.134	.445	.099	-.082	.315	.150	-.055
Relativization	.406	.114	.101	.145	.404	.103	.414	.048	-.097	.304	.064	.014
Negation	.459	.119	.155	.176	.472	.129	.490	.080	.009	.330	.013	-.112
Question Formation	.556	.164	.147	.180	.580	.074	.564	.115	-.062	.340	.036	-.053
Verb System	.475	.125	.132	.165	.489	.148	.511	.073	-.067	.353	.069	-.044

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